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CANCER OF THE STOMACH

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CANCER OF THE STOMACH

BY

A. W. MAYO ROBSON, D.Sc., F.R.C.S.

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NEW YORK
WILLIAM WOOD AND COMPANY
MDCCCCVII

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PRINTED IN LONDON, ENGLAND

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PREFACE

IN responding to the Editor's request to write a small work on Cancer of the Stomach for the Nisbet Modern Clinics Series, I have tried to carry out his wish to make it practical and useful. In doing this it will be noticed that I have omitted much that might have been written on the pathology of the subject, and in other ways have laid myself open to criticism; but if it proves helpful to the busy practitioner and furthers in any way the early recognition and early surgical treatment of the disease, I shall have accomplished my purpose.

A. W. M. R.

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LONDON, W.

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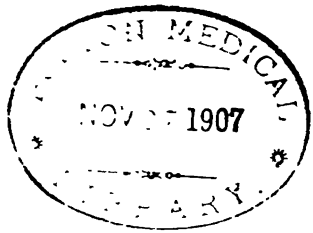

CANCER OF THE STOMACH

CHAPTER I

INTRODUCTION WITH SOME GENERAL REMARKS ON CANCER

It would seem hardly necessary to find any excuse for the publication of a monograph on cancer of the stomach and its treatment, for when it is realised how frequent gastric cancer is and that the disease is at first local and curable in a considerable proportion of cases by early removal, the stomach being in fact invaded more frequently than any other organ accessible to direct observation, it is curious that surgical treatment of this disease has not yet received more attention.

Though cancer is distinctly amenable to treatment and is probably really curable if radically treated in its early stages, yet the fact remains that though frequently relieved it is very seldom actually cured.

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The explanation of this anomaly can only be ignorance or prejudice ; for clinical observers, both medical and surgical, in various parts of the world have for some years not only been writing on the subject and trying to convince the profession and the public of the needs and the possibility of an early diagnosis with a view to successful radical treatment, but they have also clearly demonstrated the possibility of successfully practising what they have preached both with regard to diagnosis and treatment.

As regards the frequency of carcinoma of the stomach, Dr. C. N. Dowd (*Medical Record,* 1906) called attention to the fact that according to the census reports there were no less than 9000 deaths from cancer of the stomach in the United States in 1900, and of these very few had been submitted to surgical treatment. I find on referring to the Registrar-General's report for England and Wales that during the years 1901–1904 no less than 19,607 deaths from cancer of the stomach were registered, equal to 4901 per annum. Professor Osler has pointed out that in the years 1901–1905, while there were 24,750 deaths from cancer of the stomach there were only 19,675 from cancer of the uterus, and 14,418 from cancer of the breast.

Sanitarians and statisticians, English and foreign, have called attention to the marked increase in the mortality from cancer, at the same time that there

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has been a gratifying decrease in the death rate from infectious disease. In England during the last thirty years the recorded death rate from cancer has nearly doubled, while in America it has almost been trebled. Doubtless this may be partly due to greater accuracy in diagnosis, for the increase has been largely recorded in the internal organs and much less in accessible parts. But, as stated by Dr. Roger Williams, there has not only been uniformity in the variations of the increments in the long accession of years, but the increase has involved all parts of the body without material alteration in the normal proportionate ratios ; moreover the increase has been recorded in most civilised countries.

The importance of the subject is arousing wide-spread interest both within and outside the profession; and not only at home but also abroad large sums of money are being granted both from private and public sources for the investigation of the disease.

Of the true cause of cancer we really know nothing; even if we could accept the view of those pathologists who consider malignant disease as simply due to an alteration of somatic into generative elements we should be still begging the cause ; nor can we accept unreservedly the statement of a distinguished authority that, from the histological character, method of growth, and absence of specific symptomatology, it is not permissible to seek for the causative factor of cancer outside the life processes

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of the cells, for our present knowledge does not warrant such a positive statement; and it would appear from the observations of several competent pathologists that facts are not incompatible with the theory that cancer may be produced by an intra-cellular parasite which stimulates the cell to excessive multiplication. The fact that no parasite has been hitherto discovered is no proof that the quest is hopeless, and should be no deterrent to a continuance of research work. How many years were spent in fruitless search before Koch found the tubercle bacillus—a discovery that has placed tuberculosis on quite another platform, and one which bids fair to the stamping out of the disease. Does anyone doubt the origin of measles or scarlet fever from organisms? Yet absolute proof is still wanting. The origin of syphilis has only just been revealed by the discovery of the *Spirochæta pallida*. Recently Councilman has apparently proved that vaccine bodies form one phase of the life-history of the protozoon said to cause smallpox, and Dr. Roswell Park and Dr. Gaylord regard the cell inclusions in cancer as being of the same nature, though the presence of these organisms in cancer tissue is, of course, no proof that they are the cause of the disease. The same remarks apply to Bosc's arguments and experiments on sporozoa. That bacteria are not the only possible pathogenic parasites the history of malaria has proved. We

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are still in almost total ignorance of some of the lowest forms of life and of their biological peculiarities, nor are we sure that Koch's laws will be valid for them.

Even of the predisposing causes of cancer we know next to nothing, though of theories there are many. My friend the late Sir William Mitchell Banks and others thought overfeeding might afford an explanation; one physician asserts that it is uric acid, and would limit the intake of nitrogen; whereas others consider it due to an excess of carbohydrates, and suggest that starches and sugar should be limited. The teetotalers, of course, find in alcohol a possible cause, and the non-smokers decry tobacco. Some advise us to eschew salads and all uncooked vegetables and others would have us abolish salt as an article of diet. In fact, there is scarcely any form of diet or luxury that has not at one time or another been condemned. Do not all these theories make one feel that until something definite is found out, the public have a just cause of complaint against those who, on insufficient evidence, not only would cut off their luxuries one by one, but would even tax the necessaries of life with suspicion?

One exciting cause only we are certain of, and that is *irritation* in a variety of forms. Another fact we can absolutely prove is that cancer is at first a local disease, and only later a constitutional malady. Mr. Jonathan Hutchinson insisted on this

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thirty years ago, and it has been confirmed by modern research, as the following statement by Dr. Bashford will show:

"Our observations on animals show that malignant growths are always local in origin, and of themselves produce no evident constitutional disturbance whatever. These facts are in full accord with accumulated clinical experience in man."

Cancer is undoubtedly auto-infective, hence the danger of an imperfect operation, which, by distributing the cancer cells, implants numerous foci of disease. I recently saw a marked example of such a condition in a patient who consulted me with a view to operation. She gave the history of having had a cancer removed from the breast over three years previously by a radical operation; at the end of that period a small lump was noticed in the clavicular portion of the pectoral muscle, the skin being healthy and non-adherent. A surgeon removed the muscle, including the lump, but finding enlarged glands at the top of the axilla he attempted to get them away by digital enucleation, with the result that they burst and infected the whole of the wound, which, however, healed by first intention. Within two months every needle puncture was the site of a small cancerous nodule, and numerous other nodules appeared over the chest wall and over the clavicle and shoulder, leading to a rapidly fatal termination. We must all have seen similar cases, and the lesson

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conveyed is that, if possible, cancerous tumours should be removed without preliminary incision, leaving a wide area of healthy tissue around the growths, and wherever practicable the nearest lymphatic glands and vessels going to them should be removed, whether enlarged or not. If the glands be already infected it is of the utmost importance that they should be taken away cleanly without rupture, and wherever possible in the same piece as the tumour. If for diagnostic purposes the tumour has to be incised, the exploratory incision should be closed by sutures, the skin purified, the knife and needles boiled and the surgeon's hands sterilised before proceeding with the operation. If, unfortunately, the wound has become soiled, it should be irrigated with a large quantity of saline solution or some antiseptic lotion, so as to wash away any loose masses of cancer cells or infective material, which if left will probably become engrafted and grow as in the case that I have mentioned.

My friend Dr. W. J. Mayo, of Rochester, U.S.A., insists on the importance of searing the edges of the stomach wound with the actual cautery after partial gastrectomy, in order to avoid leaving any infected surface after the removal of a gastric cancer; and the importance of that I would strongly emphasise should it be necessary to incise the gastric wall near the growth, though when the incision is made wide of the tumour this is no longer necessary.

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Some English surgeons apply absolute phenol for the same reason to any doubtfully infected surface after removal of a cancerous tumour. So long as the tumour is not ulcerated it is probably not contagious, but from the moment that ulceration occurs transmission to the patient or others, granted a suitable medium, may be possible. Such transmission is, however, probably rare, as the conditions necessary to a successful transmission must be difficult to realise.

The following facts among others that could be related seem to prove without doubt the auto-infectivity of ulcerated cancer. Williams (*British Medical Journal*, 1887, p. 1369) relates a case of an ulcerating cancer of one thigh infecting the opposite thigh by contact. Cripps reported a case of ulcerating cancer of the breast infecting the skin of the inner side of the arm, where it had come in contact with the growth. Roswell Park, Waldegar, Quincke, myself, and others, have seen cancer to involve the whole length of the trocar puncture after tapping for ascites due to abdominal cancer. I have seen the needle punctures and the adjoining skin, previously healthy, to become infected after the removal of cancer of the ovary, and Sippal has quoted some similar cases. I have seen and others have reported cases of a supra-pubic drainage opening becoming infected after removal of epithelioma of the bladder. Hurry Fenwick has

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noted its transmission from one surface to another of the bladder, an observation which I can also confirm. I have heard of a case where an epithelioma of a projecting lower lip, which could just touch the tip of the nose in an edentulous old man, gave rise to a similar growth on the tip of the nose, and I have seen a second epithelioma to arise on the upper lip opposite to an epithelioma of the lower lip, and a growth to arise inside the cheek opposite to an epithelioma of the jaw and also opposite to one of the tongue. Schimmelbusch has reported cancerous infection of the lip through the finger-nails of a patient who was handling his cancerous ear.

It would form an interesting subject for inquiry to ascertain how often cancer of the stomach follows on, or accompanies cancer of the œsophagus and cancer of the tongue and mouth owing to the swallowing of cancerous particles. Such cases have been reported by Cornil, Klebs, Lurcke, and Menetrier. That the two are often associated is recognised, but I suspect that the association is more frequent than is generally supposed.

From these observations it seems highly probable that cancer is both contagious and inoculable under certain rare conditions among human beings, as it undoubtedly is among the lower animals.

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CHAPTER II

SURGICAL ANATOMY OF THE STOMACH

ALTHOUGH it is unnecessary to give a complete anatomical description of the stomach, yet some consideration of its surgical anatomy is called for in dealing with any branch of gastric surgery. Under pathological conditions there is no organ of the body which varies so much in size, position and relations as the stomach. When relaxed (as it is usually seen when operating or at *post-mortem* examination) it is a somewhat pear-shaped, hollow organ situated in the left hypochondriac and epigastric regions, covered in two thirds of its extent by the liver and diaphragm and to the extent of one third by the anterior abdominal wall and reaching to within two inches of the umbilicus; but it may be so contracted in certain cases of stricture of the œsophagus as to lie away from the surface, completely under cover of the liver and diaphragm; or it may be so dilated in some cases of stricture of the pylorus as to occupy

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every region of the abdomen and to extend into the true pelvis.

The general axis is inclined obliquely downwards and to the right from the only normally fixed part, the cardiac orifice; but the axis may be almost vertical as in some cases of gastroptosis, or horizontal as in some cases in which the pylorus is fixed to the under surface of the liver by adhesions, or by a short gastro-hepatic mesentery. The cardiac orifice is situated at the back of the abdomen on the left of the tenth dorsal vertebra, which spot corresponds in front with the junction of the seventh left costal cartilage to the sternum. The pyloric outlet is normally situated to the right of the eleventh and twelfth dorsal vertebræ, and when the stomach is empty the pylorus lies 2 inches below, 1½ inches to the right and 1½ inches in front of the cardiac orifice; but when the stomach is distended the pylorus lies 2½ to 3 inches to the right and 2 inches in front of the cardia, it being normally movable over a limited range.

The pylorus may, however, be firmly fixed to the under surface of the liver by adhesions, or so freely movable that when it is the seat of tumour it may be made to reach into every region of the abdomen, and I have even seen it in the pelvis.

As seen *post mortem* (if hardened by formalin) the pyloric aperture projects into the duodenum and resembles the external *os uteri*, the pyloric

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portion of the stomach being contracted to the size of the small intestine.

The pylorus is normally closed, except when food is passing, but an examination of the pylorus in a large number of living subjects during operation has convinced me that *post-mortem* findings are not always safe to argue from in the living, for I have very frequently found the pylorus patulous and readily permitting the passage of the forefinger when the stomach was empty. It may be so contracted in disease as to barely admit the passage of a probe, or rarely it may be found so patulous as to permit two fingers to pass.

A description of the stomach would not be complete without mentioning the fact that under the influence of peristalsis the shape of the stomach is not a thin-walled, flaccid sac, corresponding to the usual description as seen in the dissecting room, for when contracting it may be seen to be composed of a cardiac division somewhat globular in shape and a pyloric portion resembling thick-walled intestine.

W. D. Cannon (*American Journal of Physiology*, 1898, vol. i, p. 359) fed cats with pulpy food impregnated with subnitrate of bismuth, and then observed the movement of the stomach contents by means of the Röntgen rays. In this way the sacoular cardiac portion and the tubular pyloric portion were clearly demonstrated. He found the fundus to be an active reservoir for the food,

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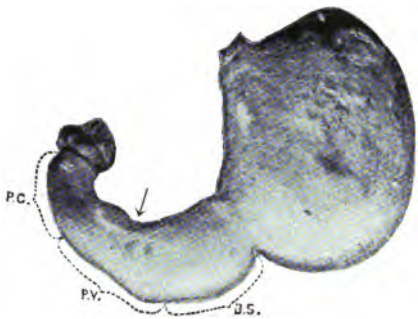
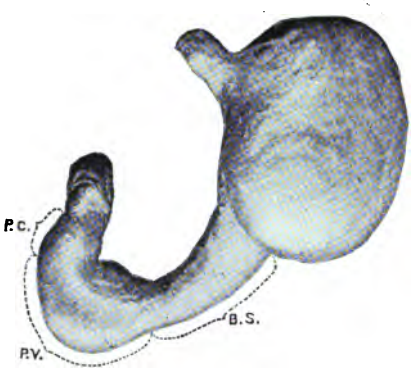
PLATE I.



Stomach of an adult female in an early stage of the emptying process.



Stomach of an adult male showing the division into a cardiac sac and a gastric tube.

To face p. 13.

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squeezing its contents gradually into the pyloric part, which then contracted on it by a series of peristaltic waves. Each wave took about thirty-six seconds to pass from the middle of the stomach to the pylorus and the different waves followed each other at intervals of ten seconds. As they passed the incisura angularis the indentation in the lesser curvature became deeper. The cardiac sac did not take part in the active peristaltic wave, but seemed to squeeze its contents gradually into the pyloric part.

Hirsch and Cannon have shown that the discharge of food takes place intermittently at irregular intervals according to the condition of the food which reaches the pyloric canal.

This functional division of the stomach is clearly shown in the appended drawing copied from Cunningham's paper, "Varying Form of the Stomach in Man and the Anthropoid Ape" (*Transactions of the Royal Society of Edinburgh*, 1906, vol. xlv, Part 1, No. 2).

The stomach has two borders and two surfaces. The upper border is known as the lesser curvature; it extends from the cardiac orifice to the pylorus and is from three to four inches in length; it is slightly concave from above downwards and to the right, and is nearly altogether on the left of the spine.

The greater curvature is about three times the length of the lesser, and is convex throughout except a small portion near the pylorus; it commences on

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the left of the cardiac orifice and arches upwards over the dome of the stomach to the left, then passes downwards and to the right, bending upwards again to reach the pylorus.

The surfaces are commonly spoken of as anterior and posterior, and when the stomach is empty this is correct; but when distended the position is altered so that the anterior surface looks upward as well as forwards and the posterior downwards and backwards.

The anterior surface is in contact above with the left lobe of the liver and diaphragm and below with the abdominal wall in the epigastric region.

The posterior surface rests on the transverse colon with its meso-colon, the pancreas, the left kidney and supra-renal body and the large vessels.

The stomach chamber.—The stomach chamber is a well-defined space in the upper abdomen occupied by the stomach. It has a sloping floor which is known as the stomach bed, composed of the front of the left kidney, the left supra-renal capsule, the gastric surface of the spleen, the upper surface of the pancreas, the transverse colon and the meso-colon, the lesser sac of the peritoneum intervening between these and the wall of the stomach except for a small area near the cardiac end where the stomach lies in direct contact with the diaphragm above the left supra-renal body. The roof of the stomach chamber is dome-like and is formed by

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part of the under surface of the liver, the left cupola of the diaphragm and the anterior abdominal wall.

It is interesting to note that a part of the under surface of the heart, near the apex, is only separated from the stomach by the pericardial sac, the left cupola of the diaphragm and the peritoneum.

The gastro-hepatic omentum, composed of two peritoneal layers, extends between the lesser curvature of the stomach and the liver, and in its right border, which is free, run the common bile-duct, portal vein and hepatic artery, this free border with its contents forming the front boundary of the foramen of Winslow.

If this suspensory ligament of the stomach is abnormally long it allows the stomach to descend below its normal level, giving rise to gastroptosis, in which case the pancreas can be seen through the peritoneal folds above the lesser curvature of the stomach.

The gastro-phrenic omentum is a small, double fold of omentum extending between the upper border of the stomach on the left of the cardiac orifice and the diaphragm.

The gastro-splenic omentum is a double layer of peritoneum extending between the left border of the great curvature of the stomach and the spleen. It contains between its folds the left gastro-epiploic artery.

The great omentum is formed by the meeting of the two layers of peritoneum which have enveloped the stomach and united at the lower border, whence it extends downwards like a veil in front of the

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transverse colon and small intestine, returning to the transverse colon, which it encloses; it then passes back to the spine as the transverse mesocolon, an important structure in the operation of posterior gastro-enterostomy. The stomach is thus enveloped by a single layer of peritoneum, the two layers of omentum splitting to enclose it, and uniting below to form the great omentum.

The investment is intimate everywhere except at the margins, along which the large vessels run tortuously, loosely enveloped in the cellular tissue intervening between the two peritoneal layers.

The muscular coat consists of unstriped muscular fibres arranged in three more or less distinct layers, longitudinal, circular and oblique. Of these three that which is of special interest is the middle layer. This, toward the pylorus, becomes thicker and stronger and when it reaches the exit from the stomach the circular fibres are heaped up so as to project inward into the lumen of the passage and form a distinct sphincter. Under normal circumstances the calibre of the pyloric orifice has a diameter of rather less than half an inch, this diminution in the calibre being caused entirely by the increase of the circular muscular fibres, the bulk of the longitudinal fibres taking no part in the process, but passing on into the first part of the duodenum, some of them, however, dipping in to join the circular fibres.

The submucous coat is composed of areolar tissue,

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and is the tunic in which the larger arterioles break up. The submucous tissue does not bind the mucous membrane very closely to the muscular layer, but permits considerable sliding of one coat upon the other.

The mucous membrane, which is thickest in the pyloric region and thinnest in the great sac, is richly supplied with glands. The whole interior of the stomach is covered by a single layer of columnar epithelial cells. Scattered throughout the mucous membrane, but most abundant towards the pylorus, are small masses of lymphoid tissue, which are of importance as occasionally ulcerating in Hodgkin's disease.

The blood supply of the stomach, which is very free, is from the three branches of the cœliac axis. The coronary artery of the stomach reaches the viscus at the cardiac end, and after giving off branches to the lower part of the œsophagus it runs along the lesser curvature from left to right, and anastomoses with the pyloric branch of the hepatic artery. From the hepatic artery two branches supply the stomach. The smaller of these, the pyloric branch, reaches the stomach at the upper margin of the pylorus, and passes towards the left along the lesser curvature to inosculate with the terminal branches of the coronary artery. The larger, the gastro-duodenal artery, passes behind the first part of the duodenum close to the pylorus, and after

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giving off the superior pancreatico-duodenal branch continues from right to left along the greater curvature of the stomach as the right gastro-epiploic artery. The splenic artery runs along the upper margin of the pancreas from right to left, and supplies several small branches to the stomach before it gives rise to the left gastro-epiploic artery, which lies between the layers of the gastro-epiploic omentum, and is continued along the great curvature of the stomach to anastomose with the terminal branches of the right gastro-epiploic artery.

From the two arches thus formed at the upper and lower margins of the stomach vessels pass at right angles to supply the body of the viscus. The ultimate branches of these form the intricate network of the interglandular tissue, and from the capillaries round the mouths of the glands the veins take origin. These in the mucous membrane are fewer but larger than the arteries. They form a plexus in the submucous tissue, and then pass along with the arteries to form larger veins corresponding to the large arteries already described—viz. coronary, left and right gastro-epiploic and pyloric veins. These all empty into the portal vein either directly, as in the case of the pyloric and coronary veins, or by joining the superior mesenteric or splenic veins.

In Mikulicz's clinic, attention was drawn to the fact that part of the venous blood from the stomach, instead of passing through the portal vein so as to be sterilised

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by the liver, is returned directly through the vascular anastomoses about the cardiac orifice. This may,

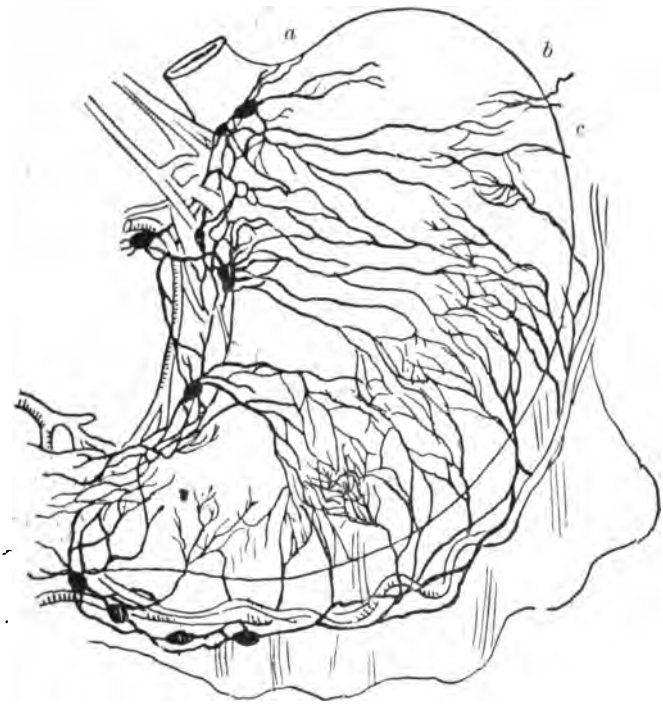

FIG. 1.—The lymphatics of the stomach. (Modified after Cunéo). *a*, *b*, *c*, glands shown by J. F. Dobson to exist in the splenic omentum and on the left of the cardiac orifice.

perhaps, account for some cases of embolic pneumonia in stomach diseases.

The lymphatics of the stomach, which are very numerous, arise in intimate relation with the gland

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tubules. They form a plexus of dilated lymph sinuses in the submucous tissue and then pass toward the upper and lower margins, where they traverse a number of lymphatic glands which lie along the gastric borders of the small and great omenta respectively. Thence they pass to the cœliac glands which lie beside the aorta above the origin of the superior mesenteric artery, those of the lesser curvature following the course of the coronary vessels until the cardiac orifice is reached, when they turn down behind the pancreas to reach the cœliac glands. Those on the greater curvature run with the right gastro-epiploic vessels, and in part with the splenic vessels, and reach the same lymphatic glands. Thence they pass together with the vessels which drain the mesenteric glands, to open into the lower end of the thoracic duct.

The dome, to the left of the cardiac opening, is much less freely supplied with lymphatics than the body and pyloric section of the stomach. This has an important bearing when considering the subject of total gastrectomy, for in some cases, even when a great part of the stomach is affected by the growth, it may be safe to leave a portion of the cardiac end and the dome.

The nerves of the stomach, derived from the terminal branches of both pneumogastrics and from sympathetic branches of the solar plexus, are very abundant, and not only account for the very severe

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pain caused by ulceration, but also for the severe collapse produced by injury, though it is a mistake to suppose that manipulation of the pylorus is attended by the severe shock suggested by the experiments made by Dr. Crile, for in many cases I have freely handled the stomach and pylorus and operated on them without the patient experiencing more shock than would be expected after any abdominal operation. When the pylorus is adherent and the parts have to be much dragged on, severe shock is not infrequently seen, but this is due to interference with the large sympathetic nerves and ganglia behind the pylorus.

The relation of the sympathetic nerves with the seventh, eighth, and ninth spinal roots accounts for the superficial tenderness of the epigastrium in ulceration, and for the reflected left shoulder-blade pain. This is well shown in pyloric adhesions complicating cholelithiasis, where, though the pain is originally on the right passing to the right infrascapular region, as soon as the pylorus becomes involved in the inflammation or tied down by adhesions the pain passes also to the left subscapular region.

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CHAPTER III

GENERAL DIAGNOSIS OF STOMACH DISEASES, INCLUDING CANCER

The time has passed in which the surgeon may rest content to act on a diagnosis already made for him, leaving with his medical confrères the onus in case of error; for he cannot shirk the responsibility of operative interference should such be found necessary. He must therefore go over the whole of the medical evidence and be prepared to supplement it by surgical methods, should such be desirable to elucidate the case.

A general and a special inquiry are necessary in every case; the former involving the question of age, sex, occupation, habits, and the mental, moral, and physical conditions, together with the history of the patient and the disease; the latter including all that can be ascertained by a physical examination. While the general inquiry must never be neglected, this chapter will be devoted to special diagnostic methods available in gastric disease.

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Abdominal regions.—I have found the method of artificially dividing the abdomen into four regions by two lines passing from the ninth costal cartilage to the opposite anterior superior spine to simplify for clinical purposes the surgical anatomy of the abdo-

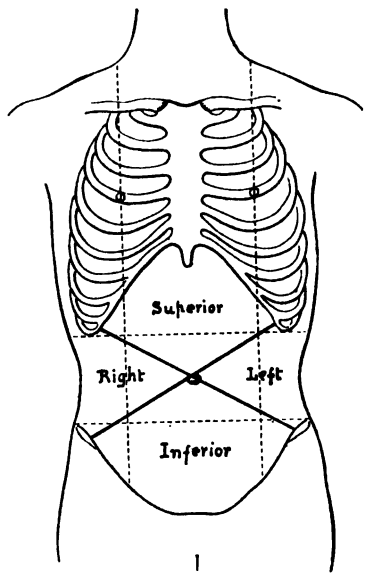

FIG. 2.

men. We can thus speak of superior, inferior, right, and left abdominal regions as shown in the appended diagram.

Inspection should always precede other diagnostic efforts. The retracted, superior, abdominal region significant of starvation from œsophageal stricture;

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the rigid, immobile abdominal wall of incipient peritonitis; the distension of the abdomen and the shallow breathing of general peritonitis; the sighing respirations in internal hæmorrhage; the irregular, catching breathing in diaphragmatic peritonitis or pleurisy due to subphrenic inflammation; the fixed and bulging ribs in subphrenic abscess; the tumour moving with respiration, often visible in cancer of the body or of the pyloric end of the stomach; the enormous bulging of the upper, or even of the whole abdomen in acute gastric dilatation; the visible peristalsis from left to right in obstruction at the pylorus, are among the many important points that may be revealed by inspection.

Palpation follows inspection, and is perhaps the method which we can least afford to omit. The rigid recti of perigastritis or incipient peritonitis; the fixed right rectus of pyloric or duodenal ulcer; the fixed left rectus of ulcer at the cardiac end of the stomach; the tenderness elicited on pressure in the superior abdominal region in all inflammatory diseases and its absence in cancer; the presence of a tumour, its nodular character, if malignant, and its mobility in the early stages; the feeling of a peristaltic wave from left to right in mechanical obstruction at the pylorus; the pylorus hardening under the hand in pyloric spasm, followed by a disappearance and then a re-appearance of the tumour; the general outline of the dilated stomach to be felt in acute

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gastric dilatation, or in a stomach artificially distended with gas or air; the occasional mapping out of an hour-glass stomach after artificial distension; the differentiation between communicated and expansile pulsation in any tumour suspected to be aneurysm, and many other points can be almost definitely settled by palpation. Bimanual palpation with one hand in the loin and the other on the front of the abdomen will often add to the information concerning a tumour or other associated condition, as, for instance, a movable right kidney dragging on the pylorus, or a distended gall-bladder fixed by adhesions to the stomach.

Succussion is a modification of palpation frequently employed to elicit a stomach splash, which, if present habitually, usually indicates pathological dilatation, and which if present five to six hours after a full meal indicates motor inefficiency or some obstruction at the pylorus, or both. Leube's method of palpating a stomach-tube through the abdominal wall is, in my experience, not of material value.

In perforating ulcer, the presence of free fluid in the peritoneum may be ascertained by flicking the abdomen with the finger-nail during palpation, when a communicated wave may be felt. The same method is useful in ascertaining the presence of ascitic fluid, which if present along with a tumour of the stomach is usually indicative of advanced cancer.

The eliciting of certain tender spots by palpation

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on the surface of the body may be of great assistance; for instance, tenderness in the superior abdominal region is suggestive of gastric ulcer and the site of tenderness to the left or right is some guide as to its position, especially when the rigidity of the corre-

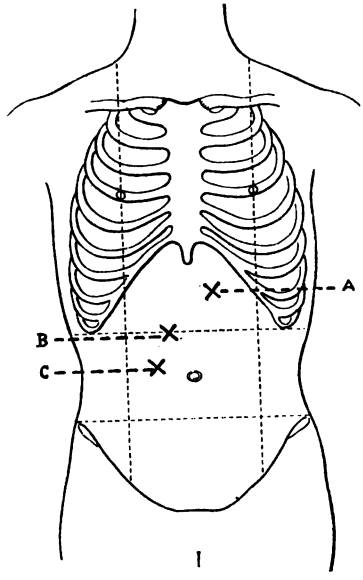

FIG. 3.—A. Usual site of tenderness in ulcer of stomach. B. Usual site of tenderness in ulcer of pylorus. C. Usual site of tenderness in ulcer of duodenum.

sponding rectus is taken into consideration. The most common site for tenderness in ulcer of the stomach is at the point marked on the diagram between the midline and the left costal margin; that for ulcer at the pylorus is usually on the right of the

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midline, and that for ulcer of the duodenum still more to the right and rather lower. In the dorsal region there are well-marked tender spots 1 to 2 in. to the left of the spine opposite the ninth, tenth, and eleventh ribs, which are present in many cases of ulcer.

Percussion is useful in ascertaining the size of the stomach, the resonance of which, when not distended with food under normal conditions should not reach below a point midway between the ensiform cartilage and the umbilicus, though stomach resonance reaching to the umbilicus does not necessarily mean the dilatation of disease. By means of percussion the size and shape of the stomach may be ascertained with the greatest accuracy, and in this way simple dilatation, dilatation of the dome of the stomach upwards, hour-glass deformity and gastroptosis may be readily demonstrated. It is more efficiently carried out after dilating the stomach, either with air pumped through a tube or by distending with carbonic acid gas, either by giving carbonate of soda and tartaric acid in water in successive doses, or by giving a tumblerful or two of soda water. If distension occurs after the administration of carbonate of soda alone, it usually indicates excess of acid in the stomach, which may point to hyperchlorhydria and ulcer. By percussion of the stomach with the patient upright, before and after drinking a measured quantity of water, the size and capacity of the stomach may be ascertained.

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In the diagnosis between a gastric or a pancreatic tumour, light percussion will reveal resonance, but deep percussion dulness in pancreatic growth, this being more marked on moderately distending the stomach with air.

Percussion is also of use in ascertaining the presence of fluid in the peritoneum, whether from ascites or from extravasation; and, in the diagnosis of subphrenic abscess, by showing the extent to which the liver is depressed by the fluid above it, and by revealing a hyper-resonant note above the liver if the abscess contains air and fluid, this being changed to a note of dulness when the patient is rotated on to the affected side.

Auscultation, when combined with percussion, may reveal the splashing sounds in gastric dilatation, and the gurgling or metallic sounds in the cavity of a subphrenic abscess containing gas; the combined methods are also of use in mapping out the extent of gastric dilatation.

When the stethoscope is placed over the stomach, and percussion is made by tapping a coin placed on the abdominal wall by means of another coin, the area of gastric resonance may be readily mapped out.

In a healthy person food occupies about four seconds in passing from the mouth to the stomach, but where there is stricture of the œsophagus the time may be delayed for from fourteen to sixteen

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seconds; this can be readily ascertained by auscultating about three inches below the left scapula, at which point the gurgle or amphoric rushing sound can be heard when fluid enters the stomach. This may be important when the question of gastrostomy for cancer of the cardiac orifice or for stricture of the œsophagus arises.

Instrumental aids to diagnosis.—In case of pending starvation from obstruction at the cardiac orifice, whether on the œsophageal or stomach side of the sphincter, the question of gastrostomy will arise; but it must first be made clear that the obstruction is organic, and not from mere spasm that might be overcome by milder means. For this purpose an œsophageal bougie may be employed, and if this is arrested at the entrance to the stomach or just before, and if the obstruction fails to yield to gentle pressure sustained for a short time, the stricture is probably organic, and if slight bleeding results from the gentle use of a bougie the stricture is probably due to cancer.

If the stricture occurs before middle age it may be desirable to give an anæsthetic before finally deciding in order to overcome spasm should that be the cause arresting the passage of a bougie.

Such a stricture may be examined directly by means of Killian's tube for œsophagoscopy, and the use of a forehead light.

Skiagraphy.—The use of Röntgen rays has a dis-

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tinct *rôle* in certain stomach cases, especially in the diagnosis of the presence or absence of metallic bodies in the œsophagus or stomach. While the Murphy button was being used in gastro-enterostomy it very frequently fell back into the stomach and remained there, in some cases setting up irritation or ulceration. I have been consulted in several such cases, and by means of skiagraphy have been able to localise the foreign body preparatory to its removal. I have also found skiagraphy of very great help where foreign bodies have been swallowed in ascertaining their position in the œsophagus or stomach; for instance, coins and dentures are thus easily localised both before and after entering the stomach; and nails, pins, needles, and suchlike bodies can be readily seen in the stomach, whence they can be removed by gastrotomy.

A further use has been made of the X rays to ascertain the size of the stomach and the situation of the pylorus by the use of the screen with the patient in the erect posture, after letting him swallow keratin-covered capsules containing bismuth, the covering of which is not dissolved by the gastric juice.

Dr. Dalton and Mr. Reid (1) have made use of a flexible tube containing bismuth, to show the outline of the stomach.

The digestive power of the stomach, an exact estimate of which is essential in the treatment of

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disorders of metabolism and diseases of the intestine, has hitherto been measured by means of Ewald's test breakfast, with the subsequent use of the stomach-tube; or by the iodine or salol reaction of the urine, as suggested by Sahli; or by estimating the reaction of the stomach contents on coagulated albumen contained in Mett's tubes. Dr. Schwarz has recently proposed a very simple method of examining the digestive power of the gastric juice, at least so far as the digestion of connective tissue is concerned. He uses subnitrate of bismuth, a substance which is well known to cast a black shadow when the X rays are directed upon it. He makes the patient swallow a large pill of about one third or half an ounce of the powdered subnitrate, enclosed in an envelope of connective tissue obtained from the appendix vermiformis of an animal such as the sheep, goat, or ox. If the abdomen of the patient is exposed to the X rays a short time after swallowing the pill a deep black spot of about the size of a farthing is seen at the bottom of the stomach. As soon as the coating of connective tissue is digested the powder is scattered and the contents of the stomach are well mixed with the powder, after which a fainter but extensive shadow, which gives the contour of the entire organ, is cast on the photographic plate or on the fluoroscent screen. This is the case in seven hours after ingestion of the pill in healthy stomachs. If the digestion is affected, as is

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the case in gastroptosis, deficiency of acid, pyloric disease and cancer, the black spot remains visible for a longer time—nine, eleven, or even twenty hours. If the contents of the stomach are digested too quickly, as in hyperacidity, the black spot disappears in from two to five hours. The method is very simple and causes no serious inconvenience to the patient.

Electric illumination may sometimes be useful in demonstrating the size of the stomach and in showing the position of a tumour, which appears as a dark patch in a light field. It is easily applied by letting the patient drink sufficient water when the stomach is empty to moderately fill it. A bougie is then passed with a small electric lamp near its extremity. It is best used in the erect posture and in a dark room.

Fluorescent media for transillumination of the stomach.—In a paper on dilatation of the stomach and gastroptosis, R. C. Kemp (2), holding that transillumination of the stomach is the ideal method of ascertaining its limits, advocates the introduction of fluorescent media into the stomach before the electric lamp is passed, by which means he has found that the brilliancy of the transillumination is increased over one half. The principal medium is bisulphate of quinine in the strength of 10 grains to 1 pint of water, with, preferably, the addition of 5 minims of dilute phosphoric acid or sulphuric acid. The fluorescence is a pale violet. Increased acidity

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intensifies its action, and fluorescence at once disappears if the solution is rendered alkaline. The other medium is fluorescin, used by ophthalmic surgeons to detect ulcers of the cornea. As is well known, it is resorcin-phthalein anhydride. In an alkaline and alcohol medium it gives a green fluorescence. The hydrochloric acid of the stomach is first neutralised by giving 15 grains of sodium bicarbonate dissolved in 8 ounces of water; or 1 or 2 ounces of lime water may be given instead and then a second draught consisting of 8 ounces of water in which are dissolved 15 grains of sodium bicarbonate, 1 drachm of glycerine, and $\frac{1}{8}$ grain to $\frac{1}{4}$ grain of fluorescin. By this means he has been able to transilluminate the stomachs of persons with thick abdominal walls, otherwise a matter of difficulty.

The removal of a portion of mucous membrane for microscopic examination by means of specially constructed forceps has been suggested and even employed by certain specialists, but it need only be mentioned to be condemned as unnecessary and dangerous.

The exploring syringe may afford useful aid in the diagnosis of sub-diaphragmatic abscess, and in exactly localising its site as a preliminary to incision and drainage.

Gastric lavage may be employed with advantage as a therapeutic measure in a number of conditions, but from a diagnostic point of view it serves a very

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useful purpose for ascertaining the quality of the gastric secretion after a test meal and the character of the retained stomach contents in chronic dilatation, also in estimating the motor activity of the stomach.

Leube's method for ascertaining the motor activity of the stomach consists in washing out the stomach at various times after a good meal—a quarter of a pound of freshly-minced meat with some bread. Within six hours the stomach should be empty, but in dilatation or other conditions in which the motor activity of the wall of the stomach is impaired some food may be found many hours later.

In cases of dilated stomach where the succussion splash is well marked and there is no vomiting it is desirable to syphon off the contents in order to ascertain the presence or absence of free HCl, lactic acid, sarcinæ or yeast fungi and other abnormal contents of the stomach. The motor activity of the stomach may be also ascertained by Ewald's test of administering salol, which is not split up in the stomach, but which breaks up on coming into contact with the alkaline pancreatic juice; the salicyluric acid resulting is excreted in the urine where it can be readily detected by the addition of neutral ferric chloride solution, a violet coloration occurring.

Fifteen grains of salol is given along with the food, and under normal conditions salicyluric acid in the urine in from 40 to 60 minutes, but

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in dilatation or other conditions in which the motor activity is impaired the time is considerably delayed.

Several instruments have been invented to test graphically the motor activity of the stomach, which, though valuable for physiological experiments, are not reliable in practice.

Chemical reactions.—In reference to the diagnosis of malignant disease of the stomach the relative abundance or absence of free HCl has been pointed out by Ewald as being of importance. In order to determine its existence the patient should take a test breakfast consisting of a cup of weak tea and a little dry toast. An hour later the stomach tube should be passed, and the contents of the stomach drawn off. These are to be tested by Gunsberg's test for free HCl. The reagent consists of 2 parts of phloroglucin and 1 part of vanillin in 30 parts by weight of absolute alcohol. When a few drops of the filtered contents of the stomach are evaporated to dryness in a porcelain dish with an equal quantity of the reagent, if free HCl be present, red crystals will form; should there be much peptone present, no crystals, but a red paste will result.

The absence or deficiency of free HCl occurs in several morbid states, but its presence is a strong point against a diagnosis of malignant disease of the stomach. Hyperacidity, on the other hand, is as characteristic of ulcer as diminished acidity is of cancer.

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The mere presence of an acid reaction should not be held as proving the presence of free HCl since this may be caused by acid salts or by free organic acids. Of these latter the most important is lactic acid, and it the practitioner should be able to recognise, since its presence in appreciable quantity in the later stages of digestion is of considerable import, implying as it does that excessive fermentation is going on in the stomach. It can be readily recognised by the use of Uffelmann's reagent, which can be made by adding 1 drop of liq. ferri perchlor. to 1 ounce of a 1 per cent. solution of carbolic acid. This will give an amethyst blue solution, the colour of which is changed to yellow on the addition of the merest trace of lactic acid. Since inorganic acids decolourise Uffelmann's reagent, while sugar, alcohol and phosphates give the same reaction with it as lactic acid, it is necessary to extract the lactic acid by shaking the filtrate left after filtering a small quantity of gastric contents with ether, to allow the ether to separate from the watery solution, and after decanting it to evaporate the ethereal solution until only a few drops remain. If any free lactic acid be present, on adding some of this to Uffelmann's reagent the alteration in colour noted above will take place. The fatty acids, especially butyric acid, give a somewhat similar reaction, but only when present in larger proportions than they are found to occur

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in the stomach. The presence of lactic acid and the absence of free HCl are strongly suggestive of cancer.

Osler (3) states that in 84 cases of cancer of the stomach out of 94 examined free HCl was absent.

Examination of vomited matters.—With regard to vomit, the first thing to consider is the quantity vomited at one time. Nurses should be trained to estimate this carefully and also to preserve specimens on all occasions. In dilated stomach vomiting usually does not occur more than once daily, sometimes only every second or third day, and the quantity at any time is correspondingly large.

In ulcer of the stomach a considerable portion of the last meal may be brought up within an hour or two of its ingestion, and the pain it has caused be thereby relieved.

The smell should be considered, a yeasty smell being characteristic of dilation of the stomach, a habitually fœtid odour of cancer of the stomach, and a feculent odour of intestinal obstruction.

Vomit is usually acid in reaction; but it may be alkaline in some cases of chronic dyspepsia, or when there is much blood present.

The most important abnormal constituent of vomit is blood. In large quantities its nature is obvious, and the event is suggestive of simple ulcer; but in cirrhosis of the liver profuse hæmatemesis may occur owing to rupture of dilated veins. In

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smaller quantities the vomit has a characteristic dark appearance, resembling coffee grounds, and this may be due to cancer or simple ulcer. When the existence of blood in vomited matter is doubtful, the most reliable guide is the hæmin test, which may be done in the following manner: evaporate a small quantity of the gastric contents to dryness, powder the residue and place some along with a crystal of common salt on a microscopic slide, add a drop of glacial acetic acid and boil over a spirit lamp, cover with a cover glass and examine under a high power for the small, dark-brown crystals of hæmin. As a rule it is not necessary to add sodium chloride, since fresh blood contains sufficient of it; but since excess of the salt does not interfere with the reaction it is well to use a crystal or two.

In cancer of the stomach blood is frequently present in the vomit, often in small, sometimes in considerable, only rarely in large quantity.

Pus is sometimes, but not often vomited. In considering both pus and blood in a fluid said to have been vomited, it must be remembered that when large quantities of fluid are expelled from the lungs—*e. g.* on the rupture of an empyema into the lung, or a profuse hæmoptysis—the sensation to the patient is often as if vomiting had occurred. The presence of food and the general absence of frothiness will help to distinguish true vomit, while vomited blood is generally much darker than blood

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from the lungs. But the only reliable way to make a distinction is to inquire carefully into the facts of the occurrence. Pus in the vomit may arise from an empyema of the gall-bladder, or a pancreatic or other abscess bursting into the stomach or œsophagus.

Examination by the microscope of vomited material is usually of secondary importance, but it sometimes affords great assistance, as in the case of a subdiaphragmatic abscess under my care bursting into the lung, where the presence of half-digested muscular fibres and the absence of elastic tissue distinctly proved the source of the pus to be from the stomach and not from an abscess of the lung or an empyema; and in some cases of cancer where portions of growths or groups of cells are occasionally obtained by means of lavage. In dilatation of the stomach the sarcina ventriculi is frequently to be seen together with yeast cells. In cancer, where macroscopically there is no evidence of blood, red blood-corpuscles may often be found on microscopic examination.

An examination of the fæces is said to show the presence of blood by chemical tests almost constantly when there is cancer of the stomach, but only occasionally in case of ulcer. My personal experience of this diagnostic sign is not sufficiently extensive for me to speak positively as to its value, though I have found it of use in some cases.

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An examination of the urine for nitrogen is said to be of use in the diagnosis of cancer, as in every case of malignant disease it is said to be considerably reduced from the normal.

A diagnosis of the position of a gastric tumour has been claimed by Glaessner by means of an examination of the stomach contents.

Having determined that the gastric mucous membrane can be divided into two physiologically distinct segments, the fundus, which has a large supply of glands, and the pylorus, which has but few glands, K. Glaessner (4) describes how the localisation of tumours can be made. Pepsin and rennet are both produced by the mucosa of the fundus, but only pepsin and no rennet is secreted by that of the pylorus. It therefore occurred to Glaessner that if one examined the contents of the stomach after a trial meal in case of gastric tumour one might be able to learn more of the situation of the growth. In the cases in which he was able to test this he estimated the total acidity by means of phenolphthaleine HCl by Toepfer's reagent, pepsin by Mett's method, and rennet by its direct action on milk, within a given time. He considers that normally the pepsin should be present at 5 millimetres—that is, that 10 cubic centimetres of normal gastric juice should be able to completely digest a column of albumen in Mett's test tube measuring 5 millimetres in twenty-four hours;

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and that rennet should have the value of 1 in 100, that is, that 0·1 cubic centimetre of normal neutralised juice should be able to coagulate 10 cubic centimetres of milk at 30° to 40° C. within half-an-hour. In six cases of carcinoma of the pylorus, confirmed at the operation or at the necropsy, the pepsin was between 1 and 3 millimetres, while the rennet was normal. In seven cases of carcinoma of the fundus he found that not only was the pepsin much diminished, as in the pyloric cases, but the rennet also was diminished, or was entirely absent. He looks upon this method of diagnosis as highly valuable.

Examination of the blood.—The blood, as a rule, shows the changes found in secondary anæmia. Beyond this the information given by an examination is of doubtful value.

Krokiewicz states that there is no change in the red blood-corpuscles. In thirteen cases digestion leucocytosis was absent. Krokiewicz agrees with Lowitt that this sign is "of equal value with the absence of HCl and the presence of lactic acid." In nearly all cases the alkalinity of the blood was lessened. Osler and Macrae come to the following conclusions:

(1) Neither an increase of the leucocytes nor special variations in the forms appear to be of any moment in the diagnosis of cancer of the stomach.

(2) The presence or absence of digestion leucocy-

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tosis is too uncertain to be of much assistance in diagnosis (in twenty-two cases it was present in ten, absent in twelve).

According to Lindner and Kuttner absence of digestion leucocytosis is noticed rather more frequently in malignant than in simple disease. Hartmann and Silhol (5) have recently communicated to the Société de Chirurgie the results of some researches made on the blood of surgical patients. In the course of these researches they have become convinced that in cancer of the stomach an examination of the blood is more likely to prove useful than a chemical investigation of the gastric contents. The authors made particular investigation on two questions:

(*a*) The degree of anæmia characterised by diminution of the quantity of hæmoglobin, which may depend on the reduction of the number of globules or on the reduced proportion of hæmoglobin in their contents.

(*b*) The existence of leucocytosis. The presence of cancer of the stomach, it is held, is indicated by a well-marked association of decided anæmia with decided leucocytosis. Anæmia is marked less by the diminished number of globules than by (1) a diminished proportion of the hæmoglobin in the globules; (2) by irregularity in the form of the globules, indicating a profound modification of the elasticity and texture of the red globules; and (3) by inequality in the size of those globules that are

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not misshapen. The leucocytosis, to have any value as a symptomatic sign, should be very marked, and should affect especially the non-nucleated cells.

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CHAPTER IV

CANCER OF THE STOMACH

PRIMARY cancer of the stomach may be of the cylindrical or spheroidal, very rarely of the squamous type (Rolleston, *Journ. Pathology and Bacteriology*, August, 1905).

If the stroma be abundant the term "scirrhus or hard cancer" is applied, and if the stroma be scanty the cancer is spoken of as "medullary"; moreover, either may take on a colloid form.

Fenwick, out of 115 cases, found 63·3 per cent. of the spheroidal type, 28·6 per cent. of the cylindrical type and 7·8 per cent. in which the growth was undergoing colloid degeneration.

Of 41 cases of spheroidal-celled carcinomata 22 were of the soft or medullary and 19 of the scirrhous variety.

Such differences in classification and relative percentages in each class are found in writings on this subject that statistics as to relative frequencies of the different varieties would seem to have little value; moreover, there are so many tumours

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occupying intermediate positions between the various classes that accurate classification is really difficult.

With regard to ulceration, metastasis and secondary growths, there is no striking difference between the two chief varieties of the disease.

Secondary carcinoma of the stomach is not very common and is unimportant from a clinical standpoint, as surgical treatment is contra-indicated in all such cases. Welch collected 37 cases of which 17 were secondary to mammary cancer, 8 to cancer of the œsophagus, 3 to cancer of the mouth and nose, and 9 to cancer in other parts of the body.

An analysis of 1796 cases compiled from various authors showed the pylorus to be affected in 1110, the lesser curvature in 197, the cardiac orifice in 158, and the rest of the stomach in 331 (Furnival).

Dissemination of cancer usually occurs through the lymphatics, but growth in cancer of the stomach may be disseminated by the blood-vessels, especially the portal vein. Extension may also occur through adhesions or by direct implantation on a neighbouring surface through contact.

Extension through the lymphatics.—To Cunéo in his masterly thesis the profession is indebted for the excellent description of the lymphatic system of the stomach, which is well shown in the diagram taken from his work (p. 19). The lymphatics, as will be seen, drain into the glands along the lesser curvature as well as into those along the greater curvature,

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especially towards the pyloric end of the stomach and in the adjoining portion of the great omentum; thence the lymph passes through the cœliac glands on its way to the thoracic duct, which transmits it to the general circulation by way of the left subclavian vein.

On reaching the heart the lymph passes through the pulmonary circulation, and infective particles may be arrested in the lungs, or if passing onwards into the greater circulation they may be disseminated as emboli and lodge in any part of the body, in this way even passing back to the abdominal viscera.

When the pylorus is affected, extension takes place rapidly along the lesser curvature; the lymphatics and the adjoining glands becoming involved as far as the point where the coronary artery joins the stomach, at which place the lymph-channels pass from the lesser curvature. The reason of almost constant extension in this direction is that this is the chief course along which the lymph stream travels from the stomach.

In consequence of this early extension a mere excision of the pylorus alone for cancer is, as a rule, almost useless, since to get beyond the disease it is necessary to remove a considerable portion of the lesser curvature with its adherent lymph-vessels and glands.

The lymph-nodes on the greater curvature do not usually extend further to the left than a point near the middle.

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The dome of the stomach is almost devoid of lymph-vessels, hence in extensive gastrectomy this part of the organ can frequently be safely left to form part of the future stomach.

Mr. J. F. Dobson, in his *Arris and Gale Lectures*, February, 1907, showed the presence of a gland on the left of the œsophagus, and said that there were usually one or two lymph-nodes in the gastro-splenic omentum.

Cunéo observed that pyloric growth frequently spares the duodenum, hence when a tumour extends well into it from the pylorus the chances are that it may be inflammatory swelling around an ulcer. This fact has on several occasions enabled me to rest satisfied with a gastro-enterostomy when otherwise I should have performed a partial gastrectomy. The rule is, however, not absolute, as I have seen both cancer and sarcoma extend through the pylorus into the duodenum.

Extension by continuity.—Cancer always extends beyond the area of induration, for while the limit of induration may be the diseased mucosa, the submucosa may be involved in growth for some distance beyond, and only scattered groups of cells yielding no evidence to the touch can be discovered on microscopic examination. It follows, therefore, that any effort at extirpation must go fully an inch beyond the margins of the tumour. It is specially important that the removal should be wide of the

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disease on the cardiac side of the tumour, and that the lymphatic area along the lesser curvature should be removed.

Extension through adhesions.—In a very large proportion of cases adhesions are found at the time of operation between a cancerous tumour of the stomach and adjoining organs, especially the pancreas, liver and biliary passages. This not only adds to the difficulty of the operation but also tends to invasion of the neighbouring organs by continuity. These adhesions are due either to local inflammation set up by the growth or to extension of the malignant neoplasm.

Gussenbauer and Winiwarter state that adhesions are found in 63 per cent. of cases of pyloric cancer, a statement which my personal experience on the operating table would lead me to believe is even below the mark.

Extension through the blood-vessels is much commoner in sarcoma than in cancer of the stomach, but there are many examples of metastasis to the lungs, brain and other organs in true gastric carcinoma that can only be accounted for by vascular extension. Extension by way of the portal vein to the liver is the best example of vascular diffusion of cancer, but if infective particles pass through the portal meshwork in the liver they may be diffused by the general circulation to any part of the body.

Extension through contact is seen when the abdo-

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minal wall opposite to a fungating growth in the stomach becomes involved and when the various tissues and organs forming the stomach bed become invaded without there being any direct channel either through the lymphatics or blood-vessels to account for the extension.

Although secondary cancer of the stomach may occur subsequent to cancer of the œsophagus, breast, gall-bladder, intestine and other organs, it is not of importance from a surgical standpoint.

Cancer incidence.—*Age.*—Cancer of the stomach may occur at any period of life, from early infancy up to extreme old age, but it is most frequently met with from forty to seventy. In the census reports for 1890 the death rate from cancer of the stomach was 10·24 per 100,000 living in the registration area. On analysis this yielded 3·22 between the ages of fifteen and forty-five; 34·45 between forty-five and sixty-five, and 79·96 over sixty-five years (Osler and Macrae, *Cancer of the Stomach*, p. 6).

I have operated for cancer of the pylorus at the early age of 21, and for cancer of the colon at the age of 14.

Race.—The white races seem more predisposed to cancer than the black; Osler gives the actual incidence as 6 whites to 1 coloured.

Sex.—The various estimates of the relative frequency of cancer of the stomach in the two sexes enables one to say that it is decidedly more frequent in males than females. Osler gives it as 5·2 to 1;

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Brinton 2 to 1; Reiche 1·8 to 1; my own experience in 110 operations on the stomach for cancer has differed considerably in hospital and private. Of 55 hospital patients 30 were males and 25 females: 1·2 males to 1 female. Of 54 private patients 44 were male to 10 female; 4·4 males to 1 female.

Pre-cancerous conditions.—The so-called pre-cancerous stage of malignant disease may be due to disturbances of nutrition, to previous injury, to congenital defect, or to other departures from the normal conditions. Senility and decadence of tissues which have passed the period of their usefulness and are about to undergo physiological rest are predisposing factors. Predisposing conditions also exist in certain parts of the body where embryological vestiges or rests are found, and in certain regions, as the pylorus and the cæcum, and at the lines of junction of skin and mucous membrane. In certain situations pre-cancerous conditions can be readily recognised; this especially applies to the tongue, lips, larynx, uterus, and the skin, suggesting strongly that cancer is a new implantation on a prepared ground; probably, if we could only find it, every cancer, whether external or internal, follows on a pre-cancerous condition, such as cancer of the gall-bladder on ulceration produced by gall-stones, cancer of the stomach on chronic gastric ulcer, epithelioma of the penis on irritation under a phimosis, cancer of the bladder on papilloma or on ulcers due to calculi, and cancer

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of the rectum and colon on stercoral or other ulcers. The liability of benign tumours, especially on epithelial surfaces, to undergo malignant changes is well recognised, hence the removal of such is generally advisable.

A general acceptance of the view that cancer has usually a pre-cancerous stage, and that this stage is one in which operation ought to be performed, would be the means of saving many useful lives, for it would lead to the removal of all suspicious epithelial conditions before the onset of cancer.

I hold that the arrest or removal of known causes as well as the abolition of discoverable pre-cancerous conditions, whenever or however occurring, constitute true preventive treatment.

Pre-cancerous conditions of the stomach are in certain cases distinctly recognisable, and if diagnosed and treated might save many patients from carcinoma. As the stomach is one of the commonest sites of cancer, if even a percentage of cases can be saved from malignant disease by timely treatment a great advantage will have been gained.

Ulcus carcinomatosum.—The question of the cancerous transformation of an ulcer of the stomach was first discussed by Cruveilhier in 1839. Rokitansky, in 1840, also recognised the difference between chronic ulcer and cancer, and said that the latter might be implanted upon the former. To Dittrich, writing in 1848, belongs the chief credit of drawing

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attention to the subject. He described in 160 cases of new growth six cases of cancer developing in the immediate vicinity of active or healed ulcers, two cases of the association of cancer and ulcer, and two cases in which the cancer was limited to a certain part of the margin of the ulcer, the rest remaining sound. Brinton, in 1856, recognised the possibility of the grafting of cancer upon long-standing ulcer.

Lebert, in 1878, considered that the cancerous transformation occurred in 9 per cent. of ulcers; but Zenker, in 1882, expressed a strong opinion that all cases of cancer of the stomach were secondary to ulceration.

He attributed the cancerous degeneration in an ulcer to glandular changes caused by inflammation and cicatrisation exciting and favouring epithelial proliferation. He called attention for the first time to the persistence of free hydrochloric acid in the stomach contents in cases of cancer grafted upon ulcer.

In 1889 Rosenheim found in forty-six cases of cancer, four in which the malignant change was secondary to ulceration. In all these, free HCl was present.

G. Fuetterer, in 1902, made an extensive research into the question of the origin of carcinoma of the stomach from chronic round ulcer. His conclusions, briefly stated, were as follows:

(1) If a carcinoma develops from a chronic ulcer of the stomach then this development occurs from those parts of the edges of the ulcer which are most

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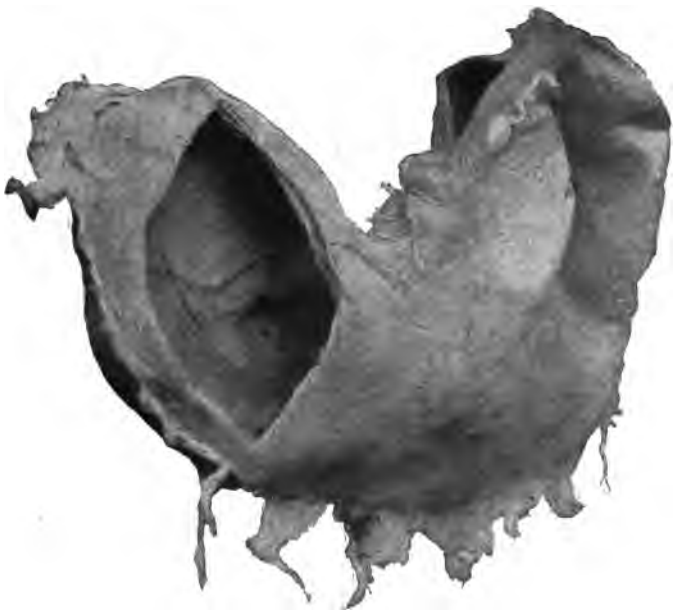
PLATE II.



Cancer of anterior wall of the stomach producing hour-glass contraction.

Man, aged sixty, with four years' history of vomiting and other signs of ulcer. This is an example of "ulcus carcinomatosum." (No. 2408c, Royal College of Surgeons' Museum.)

To face p. 52.

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exposed to mechanical irritation by the contents of the stomach.

(2) In the pyloric region it is the lower pyloric margin of the ulcer which is most exposed to mechanical irritation, and from which carcinoma develops. But other parts of the edges may be the ones involved when dilatation and adhesions have changed the position of the organ.

(3) Development of carcinoma from ulcers of the stomach in the pyloric region occurs with great frequency, while such a development occurs less often in other parts of the stomach.

In 1903 Audistere recorded examples and made very careful examination of four personal cases. His conclusions are summed up in the following manner:

(1) Simple ulcer of the stomach may be the starting-point of a cancerous growth, a condition of things which appears to be not infrequent.

(2) This malignant degeneration affects, as a rule, the chronic ulcers, especially in the pre-pyloric region. The change begins in the mucous membrane at the margin of the ulcer.

(3) The transformed ulcer presents for a long time almost the same symptoms as a simple ulcer, but the diagnosis may be made by noting the resistance to treatment, the wasting, the persistence of the symptoms, and the progressive anæmia. The pain, as a rule, is more severe than in cases of simple ulcer.

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(4) In cases of cancer, apparently primary, the origin in an ulcer may be suspected if the pain is unusually severe and paroxysmal, if hyperchlorhydria is pronounced, or if hæmatemesis or perforation occurs. The prognosis is decidedly more grave, for the progress of cancer grafted upon ulcer is more rapid and bleeding or perforation is liable to occur.

If these conclusions are correct, and my experience tells me they are, then it is quite clear that we must in all cases in which an ulcer of the stomach resists treatment, or its scar narrows the pylorus, recommend an early gastro-enterostomy or excision of the ulcer, in order to prevent the development of carcinoma. If a gastro-enterostomy has been performed, then the mechanical irritation by food of the ulcer in the pyloric region is reduced, and the friction necessary to produce a carcinoma will probably not occur. The estimates of the frequency of this malignant implantation upon a chronic ulcer vary greatly. The number of carcinomata beginning in chronic ulcer is reckoned at 3 per cent. by Fenwick, Plange and Berthold, 4 per cent. by Wollmans, 6 per cent. by Rosenheim and Hauser, 9 per cent. by Lebert, and 14 per cent. by Sonicksen. Zenker, as already mentioned, believes that all, or almost all carcinomata are secondary to ulcer. Mayo, in 157 cases of cancer of the stomach, found a previous history of ulcer in 60 per cent. In no less than 59·3 per cent. of cases of cancer of the stomach on which

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I have performed gastro-enterostomy for the relief of symptoms, the disease having advanced too far for gastrectomy, the long history of painful dyspepsia suggested the possibility of ulcer preceding the onset of malignant disease.

The origin of carcinoma in an ulcer of the stomach is only another instance added to many of which we have knowledge, of the effect of persisting irritation in establishing malignant changes. Carcinoma occurs most frequently in those areas in which the ulcers chiefly lie. Whatever the frequency of the malignant change in chronic ulcer may prove to be, the fact of its occurrence should be an additional incentive to the earlier surgical treatment of ulcers which prove rebellious.

Symptoms.—Since cancer "*per se*" has no symptoms, it not infrequently happens that if the growth involves the body of the stomach and not the orifices, it may pursue its complete course without giving rise to any definite local symptoms, and it has happened that the cause has only been discovered at autopsy. This form of latent cancer contributes 5 per cent. of all cases according to Professor Osler, who also gives it as his opinion that 10 per cent. of all cases of cancer of the stomach run an extremely rapid course, terminating in death within three months.

Dr. Newton Pitt (4) drew attention to seventeen obscure gastric cancer cases that had occurred in Guy's Hospital, in which the main symptoms had been

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unconnected with the stomach. They are classified as follows :—

Group	A.	Ascites and pleuritic effusion .	7 cases
„	B.	Matted intestine . . .	3 „
„	C.	Intestinal obstruction . .	2 „
„	D.	Abdominal suppuration . .	2 „
„	E.	Profound anæmia . . .	2 „
„	F.	Iliac tumour . . .	1 case
„	G.	Thrombosed veins . . .	? „

In all the gastric symptoms were trivial, and in many the stomach disease was only discovered at autopsy.

In the ordinary course the symptoms commence with loss of appetite and want of vigour, often coming on in an individual suddenly and without any apparent cause; loss of flesh is soon noticed, with pallor and shortness of breath, discomfort after food is usually felt, which may pass on to pain and a feeling of sickness, and after a time vomiting of food, little or much altered. At first the vomit is usually free from blood, but in the later stages, when the cancer begins to ulcerate, it is signalled by coffee-ground vomit. Rarely blood is vomited in quantity, and only very rarely does hæmatemesis assume a serious form in gastric carcinoma, though I have known it to directly cause death on four occasions. Pyrosis is frequently complained of in the early stages of the disease. The bowels are usually constipated. After a longer or shorter interval, weeks,

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PLATE III.

Cancer of cardiac orifice of the stomach.
(No. 2422, Royal College of Surgeons' Museum.)

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or may be months, a tumour may develop in the epigastrium, and then the symptoms are usually so well marked that no doubt can be entertained as to the condition. Enlargement of the supra-clavicular glands on the left side and dulness beneath the left clavicle are important signs indicating advanced disease.

On quite a number of occasions I have been consulted for abdominal tumour due to cancer of the stomach without any of the characteristic signs, except general failure of health and loss of flesh, but in such cases the orifices of the stomach have not been involved in the growth. In the later stages profound anæmia, œdema of the limos, ascites and increasing weakness herald the approach of the end.

If the disease is at the cardiac end of the stomach, involving the cardiac orifice, the symptoms may resemble those of stricture of the œsophagus and be associated with dysphagia ending in an inability to swallow at first solids and later even fluid nourishment; in such cases the tumour, being well under cover of the ribs, is difficult or impossible to palpate, but enlargement of the supra-clavicular glands on the left side is usually present.

If the pylorus be the part involved dilatation of the stomach with retention and decomposition of food and vomiting are pronounced symptoms, the vomiting, being at first irregular, perhaps every

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second or third day, soon becoming daily, and later occurring after every meal.

Visible peristalsis is not usually so marked as when the dilatation is due to simple stenosis, but it may be a prominent sign, and is then usually associated with pain that is relieved by vomiting.

If the disease attacks the centre of the stomach it may lead to hour-glass distortion with visible peristalsis of the proximal portion.

In some cases the neoplasm invades adjoining regions, as the pancreas, transverse colon, gall-bladder and bile-ducts and liver, producing characteristic symptoms such as jaundice and intestinal obstruction.

The special symptoms, pain, vomiting and tumour, may be considered more in detail.

Pain is very variable and may be entirely absent throughout the course of the disease, or there may be discomfort and fulness after food not amounting to actual pain. These painless cases Brinton gives as 8 per cent., Lebert 25 per cent., and Osler as 13·3 per cent.

In the majority of cases, however, estimated at from 80 to 90 per cent., pain is a prominent symptom. It may be continuous, with exacerbations after food, or may only be felt after meals, especially after solids have been taken.

When the pylorus is involved, leading to stenosis, peristalsis is usually accompanied by severe pain of a crampy character which is relieved by vomiting.

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The pain is usually referred to the epigastrium, occasionally passing through to the back, especially in the left subscapular region, or even being only felt there.

As a rule tenderness is absent, the disease then presenting a great contrast to gastric ulceration.

Vomiting occurs in 85 per cent. of cases of cancer of the stomach; it is usually a later symptom than pain. If the stomach is dilated, the vomit may be large in quantity every second or third day, and I have seen material vomited that had been taken three or four weeks previously; the vomit may be offensive and fermenting, more so than is generally seen in ordinary cases of dilated stomach. If the stomach is small, vomiting usually occurs oftener and in smaller quantity; but when the disease is involving the cardiac orifice there is regurgitation of food, but no actual vomiting.

Blood is vomited in about half the cases in my experience, though Professor Osler only gives it as a percentage of 28·1. It may be bright in colour and very profuse, though it is usually dark, like coffee-grounds. In four cases of cancer of the stomach I have known hæmatemesis to cause death.

Fever of a hectic type is present in about half the cases; it is, however, irregular, and may be absent or the temperature may even be subnormal throughout.

Tumour is discoverable in about 80 per cent. of all cancers of the stomach, and it is most unfortunate

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for radical treatment that in such a large proportion of cases this sign should be waited for before the diagnosis is made and surgical treatment sought, for tumour is, as a rule, a late manifestation, and usually affords evidence that the disease is no longer local.

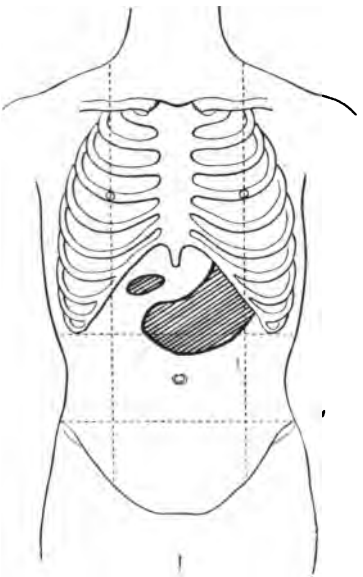

FIG. 4.—Various positions in which tumour may be felt in cancer of the stomach.

Though the presence of a tumour makes it probable that in case of removal of the growth there will be recurrence, yet the rule is not without exception, as in my own experience I have a patient living and well over six years, another over five years, and others at lesser periods after gastrectomy

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where tumours were perceptible before operation. Kocher and other surgeons have had similar experience.

We should be able to make our diagnosis (if needful by an exploratory operation) before a tumour can

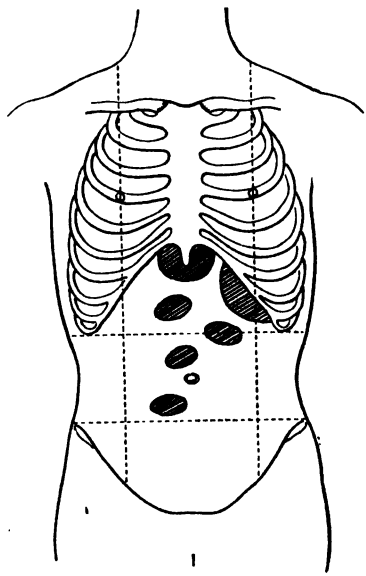

FIG. 5.—Various positions in which tumour may be felt in cancer of the stomach.

be felt, if we want to obtain the best results from the surgical treatment of gastric carcinoma.

Inspection will often reveal a tumour if present, and in more than half of the cases I have observed, the tumour has been seen visibly moving up and down during respiration. After manipulation, inspection

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will frequently reveal visible peristalsis in a stomach dilated from obstruction at the pylorus, or in the proximal portion of a cancerous hour-glass stomach.

Palpation is of service, not only in discovering a tumour, but in estimating its mobility in a vertical or transverse direction, and helping to form some idea as to the possibility of removal; a tumour that is freely movable during respiration or under manipulation may, however, be too fixed for successful removal.

A malignant tumour is, as a rule, nodular and irregular, but it may be smooth, and it may vary in size from time to time on account of the rigid contraction of the gastric muscular coat on its proximal side; it is usually devoid of tenderness, and unlike inflammatory swelling there is generally an absence of rigidity of the muscles overlying it.

Much information as to the position and size of the tumour may be obtained by palpating the abdomen with the stomach artificially inflated by carbonic acid gas, and again by examining it when it has been emptied.

Although tumours of the stomach usually occupy the epigastrium, they may be found in any part of the abdomen, even in the pelvis. I have removed a pyloric tumour that could only be just felt beneath the left costal margin, and have also removed one that I could easily manipulate into every region of the abdomen.

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PLATE IV.

Extremely small stomach dependent on neoplasm—'leather-bottle stomach.'

(No. 2408, Royal College of Surgeons' Museum.)

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A tumour may be formed by an atrophic cancerous stomach (leather bottle stomach), in which the walls are thickened by cancerous infiltration and the lumen much diminished. A photograph of such a case from the Royal College of Surgeons Museum is shown.

This condition may be simulated by cirrhosis of the stomach, but the history is much longer in cirrhosis, though the symptoms may be almost identical, so similar is the appearance of the two conditions that a naked-eye inspection cannot always differentiate them, and, in fact, an examination by the microscope of several museum specimens labelled cancer has shown them to be simple in character.

In 54 per cent. of cases the tumour is at the pylorus, in 16 per cent. on the lesser curvature, in 9 per cent. at the cardiac end, in 3 per cent. on the anterior wall, in 4 per cent. on the posterior wall, in 4 per cent. on both walls, in 4 per cent. on the greater curvature, and in 6 per cent. it is diffuse (Lebert).

Enlargement of the supra-clavicular glands on the left side is important positive evidence of cancer of the stomach, and the sign may be present when an abdominal tumour is not to be felt; but the absence of this sign, as pointed out by Riegel, has no value as negative evidence.

The supra-clavicular glands on the left side are more frequently involved in cancer of the stomach

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than is generally supposed, and, as had been shown by Dr. Mitchell Stevens, (*British Medical Journal*, February 9th, 1907), in many cases careful percussion will show the presence of glandular enlargement in the clavicular and infra-clavicular regions, and may thus give a clue to the nature of an abdominal disease. It is possible that these glands become infected through "regurgitation" of infected lymph conveyed by the thoracic duct from the site of disease, but more frequently infection occurs by direct communication of the disease along the walls of the thoracic duct extending along the lymph-vessels to the glands. The right clavicular glands are seldom affected.

Rarely the left axillary glands are enlarged, and left inguinal glandular enlargement has some value as a positive sign.

Ascites is not a common accompaniment of cancer of the stomach, and when present may obscure the other signs and lead to difficulties in diagnosis; it usually occurs when the growth invades the serous coat and forms secondary deposits in the peritoneum; it is therefore a late sign and contra-indicates surgical treatment.

Perforation of the stomach from cancer is not a very rare complication. Brinton gives it as 3½ per cent., Osler says 4 per cent. In cancer, the perforation usually occurs slowly and leads to a local abscess, very rarely to acute perforative peritonitis, though I have seen a perforating carcinoma to

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present symptoms as acute as those of perforating peptic ulcer.

Metastases occur in 3 out of 4 cases according to Ewald, or according to Osler in 39 out of 45 cases. The largest number occurred in the lymph-glands—a total number of 30; and of these the gastro-hepatic were affected in 21, the peritoneal in 9, posterior mesenteric in 6, supra-clavicular and posterior mediastinal in 2, iliac, bronchial, pericardial, anterior mediastinal and axillary in 1 each. The liver was the seat of metastases in 23, peritoneum 11, pancreas 8, bowels 8 (small bowel 3, colon 2, duodenum 1), kidney and lungs each 4, pleura 3, spleen and diaphragm each 2, ribs, vertebræ, skull, ilium, femur, heart-muscle, pericardium, abdominal wall, vesico-rectal *cul-de-sac*, hydrocele sac, and ureter each 1.

Metastasis along the round ligament extending to the umbilicus was noted by Wickham Legg, and has since been frequently observed; I have seen it several times in late cases and have found it at operation undertaken at a time when it was hoped the disease might prove to be removable. It shows itself in the late condition as a hard cord extending to and involving the umbilicus, and this sign may be present when no tumour can be felt.

Ulceration.—If the subject of gastric carcinoma survives for a sufficient length of time the disease will break down leading to ulcer, but the patient may die before ulceration occurs. Osler and McRae

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found ulceration in 35 out of 44 cases that came to autopsy.

Jaundice may be due to direct invasion of the bile-ducts or to secondary nodules in the liver; it is usually a late and always a very serious sign.

Œdema of the feet is a late sign often dependent on anæmia, which is always present in the later stages of the disease.

Interstitial pancreatitis, as shown by Cammidge's reaction in the urine and the presence of fat and muscle-fibres in the fæces, may occur early in the disease if the growth becomes adherent to the pancreas, but before it has extended into the organ; but when the pancreas has become invaded by the growth the symptoms become exaggerated and the crystals obtained from the urine by Cammidge's reaction take two to three minutes to dissolve in dilute sulphuric acid, instead of half a minute.

If the pancreatic duct is involved, the fæces, normally alkaline, become acid, and the constipation usually present may give place to bulky pale motions with a tendency to diarrhœa.

The character of the vomit or of the stomach contents. —If the patient is sick, the vomited matter can be examined, but in the absence of sickness, lavage of the stomach should be performed an hour after an Ewald's test meal. Before coming to a definite decision it is desirable that the analysis should be repeated several times.

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The absence of free HCl is in favour of cancer, as is the presence of lactic acid, but the presence of some free HCl and the absence of lactic acid have no negative value.

In gastric carcinoma there is seldom found a normal amount of free HCl, and never an excess except in ulcus carcinomatosum ; the presence of an excess of free HCl is therefore decidedly in favour of ulcer.

In ulcus carcinomatosum, however, there is usually a large amount of free HCl in the stomach contents after a test meal.

In 90 per cent. of cases of cancer collected from various sources by Professor Osler there was an absence of free HCl in the stomach contents.

Digestive properties of stomach contents.—This may be proved by testing the digestive power on albuminous foods of the fluid removed after a test meal, or by Schwarz's method of examining by the Röntgen rays after the patient has swallowed a bolus of bismuth wrapped in an envelope of connective tissue obtained from the appendix vermiformis of a sheep.

In healthy stomachs six to seven hours after the bolus is swallowed the connective tissue envelope should have dissolved, and the bismuth will be distributed, but if digestion is impaired the bolus may remain unbroken for from ten to twenty hours later, and will be seen as a deep black spot when the X rays are used.

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Microscopic examination.—The presence of new growth in the vomit or in the fluid removed by lavage is, of course, of prime importance, but it can only rarely be found, and it is quite unjustifiable to attempt to obtain it by mechanical means, such as scraping or brushing away portions from the gastric wall.

The discovery of the Oppler-Boas bacillus, a long, non-motile bacillus of the shape of a base-ball bat, is said by various authorities to be an indication of carcinoma, but while its presence is presumptive evidence in favour of carcinoma its absence has no negative value. This bacillus is usually found when lactic acid is present in the lavage.

The presence of yeast cells and sarcinæ is common to dilatation of the stomach with retention, both in simple and in malignant disease.

The discovery of blood cells may be due to ulcer or cancer; it is therefore simply a sign of serious organic disease.

The motor functions of the stomach are best tested by examination of the stomach after a test meal; such impairment may be due to pyloric stenosis from any cause, or due to cancer of the body of the stomach, or even to chronic gastritis, but in neurosis the motility of the stomach is increased. The stomach ought to be always found empty the first thing in the morning after a meal taken at 10 p.m., but in health there should be no food present in the stomach six hours after the last meal.

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Diagnosis.—In advanced carcinoma there is usually little difficulty in making a diagnosis, the only mistakes that would be likely to occur being either the mistaking of an inflammatory tumour associated with ulceration, or the mistaking of a syphilitic tumour for a malignant growth. In the latter case the history and the result of specific treatment afford clues to the diagnosis. In the former, induration around an ulcer, the long history, the tenderness on manipulation, and the presence of free HCl in the vomit or in the lavage should be of assistance; but all surgeons who have had any experience must have found a difficulty at times in deciding on a diagnosis between inflammatory disease and growth, even when the abdomen is opened.

In several patients of this kind on whom I have operated for large growths at the pylorus, or in the body of the stomach with extensive adhesions rendering removal impossible, and with enlargement of the glands rendering malignant disease extremely probable, I have performed gastro-enterostomy with the idea of giving relief; yet ultimately complete and perfect recovery has occurred, and the patients are living and well years later, showing that the supposed cancer was evidently only inflammatory thickening around an ulcer, which was cured by setting the parts at rest.

The presence of numerous adhesions, the discrete character of the enlarged glands, which are softer

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than cancerous ones, the absence of secondary deposits in the viscera, and the absence of fungating growths in the tumour itself are, when taken with the former-mentioned points, in favour of simple tumour, but as acknowledged by Osler, Halsted, Finney, and many other workers, it is impossible in some cases without a microscopic examination to distinguish between simple imflammatory tumour and cancer. Fortunately operation is of service in both conditions, therefore no harm, but only good, should result from the performance of gastro-enterostomy in either disease; and even if the pylorus be removed for chronic ulcer thinking it to be cancer, and a new healthy passage into the bowel be established, the patient should be the gainer.

Hypertrophic stenosis of the pylorus is comparatively rare at the age in which cancer is usually found, and it has only once happened to me to mistake this condition for a neoplasm, the pylorus forming a perceptible tumour. On opening the abdomen I found the pyloric tumour smooth and uniform, and on exploring the stomach I found a chronic ulcer, which, by keeping up a state of irritation over a long period, had led to spasm and hypertrophy of the pylorus and to gastric dilatation. The excision of the ulcer and the performance of gastro-enterostomy cured the patient and led to the subsidence of the hypertrophy of the pylorus. Boas (5) has called attention to three cases of this kind in

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which the irritation gave rise to a mistaken diagnosis. It is, however, in the early stages that errors in diagnosis are most likely to occur, leading to a fatal delay in cases that, if diagnosed early, can be cured by a radical operation; for it is undoubtedly proved that at first the disease is purely local and that its complete removal may be absolutely curative.

Treatment.—Medical treatment may be considered in a few words: it cannot cure, and can do very little even to prolong life; it therefore applies only to cases too advanced for surgical treatment or where operation is declined. It aims at nourishing the patient as much as possible, and at relieving pain or other symptoms as they arise.

Surgical treatment offers the only chance of relief and the only possible chance of cure, and in order that the best results may be obtained, the physician and surgeon must act in concert, so that by a timely diagnosis an operation may be undertaken at the earliest possible date. There is ample evidence to show that for some length of time cancer is a purely local disease; and just as in the breast, the tongue, and the uterus, we can point to patients living comfortable and happy lives years after the removal of the disease, so in gastric cancer it is reasonable to assume the same possibilities. Here, however, we are faced with the difficulty of a sufficiently early diagnosis being made, and it is not only necessary for us to appeal for an early, exhaustive, and

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persistent investigation into suspicious stomach cases, but that when the suspicions are becoming confirmed an early surgical consultation may be held, and, if needful, an exploratory operation carried out to complete the diagnosis. Whenever a patient at or after middle age complains somewhat suddenly of indefinite gastric uneasiness, pain and vomiting followed by progressive loss of weight and energy, and associated with anæmia, the possibility of cancer of the stomach should be recognised, and in a suspected case, if no improvement takes place in a few weeks at most, and if repeated examinations of the stomach contents after test meals show diminished digestive power with a diminution or absence of free HCl and the presence of lactic acid, an exploratory operation is more than justified. As Professor Osler says, the important aid of an exploratory operation should be more frequently advised.

Let us remember also that to prolong the investigation uselessly and to wait until a tumour develops is to lose the favourable time for a radical operation; and although a clinical examination of the stomach contents and a general examination of the patient may give us strong grounds for suspicion, our diagnosis can only be rendered certain by a digital examination, which may be effected through a small incision that can, if needful, be made under local anæsthesia, though better under general anæsthesia with little, if any, risk.

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At the time of the exploration it will be generally advisable to have everything ready to follow up the exploratory procedure by whatever further operation may be called for. It may be discovered that the disease is manifestly not yet malignant, and that some curative operation is necessary to bring about relief.

Or it may be found that the disease resembles malignancy both in its history and physical signs, and in the form of the tumour, which, on account of extent and adhesions, and from the presence of enlarged glands, it seems impracticable to remove with any hope of permanent success, but in which a gastro-enterostomy or some allied operation may be called for in order to give relief, or maybe to effect a cure.

The following examples selected out of many such cases on which I have operated, and which were at the time of operation extremely ill, and supposed to be suffering from cancer of the stomach, are as the result of surgical treatment in good health years later.

(1) A medical man, aged thirty-one years, who was seen with Dr. B— and Dr. W—, had had dyspepsia for seventeen years; this had been more severe during the preceding twenty months. Sixteen months previously vomiting began, and from the outset large quantities were ejected, but never contained blood. There was occasional recurrence of similar attacks,

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which were always relieved by treatment. In December, 1897, the stomach reached to the pubes, and visible peristalsis was present. Relief followed dieting and lavage until March, 1898, after which time the pain was almost constant, and was not materially worse after food or relieved by vomiting. A loss of weight had occurred, from 10 st. to 8 st. 6½ lb. There was great feebleness. Gastro-enterostomy was performed on May 6th, 1898. A large irregular tumour was found at the pylorus and along the lesser curvature with extensive adhesions, but the glands, though large, were discrete. A good recovery was made and was followed by relief of all symptoms. When the patient left the home on June 7th his weight was 8 st., on August 17th, 1898, it was 9 st. 3 lb. The following is an extract from a letter from the patient, dated February 12th, 1900: "My health continues perfect. I have not lost a day's work through illness since I recovered." He is in good health in 1906, eight years after operation.

(2) Mr. B—, aged thirty-nine years, seen December, 1901, on account of pain about two hours after food, with the passage of melæna and great loss of flesh. An indefinite tumour could be felt. On opening the abdomen on December 19th, 1901, a tumour was discovered involving the pylorus and the first and second part of the duodenum, which were thickened and infiltrated, forming a sausage-shaped tumour, very hard and nodular and adherent to the neigh-

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bouring parts, so that it was impossible to remove it. A posterior gastro-enterostomy was therefore performed, the operation being concluded under the idea that the patient was suffering from cancer. As events proved this was clearly an error, for in January, 1903, he wrote to say that, although he had had two attacks of pain due to over-indulgence, he was very well and able to do his work, and that the stomach swelling had entirely disappeared.

(3) The patient, a man, aged forty-five years, gave a history of pain for two years about an hour after food, with great loss of flesh. For nine months he had vomited every day or every second day a large quantity of yeasty material, but no blood, though he was very anæmic. There were well-marked signs of dilatation of the stomach, with tenderness over the pylorus, and the presence of a tumour. Posterior gastro-enterostomy was performed on June 12th, 1900. On opening the abdomen the pylorus was found to be much thickened and adherent, forming a hard, nodular tumour having the appearance and feel of cancer. Through the centre of the mass a No. 10 catheter only could be passed over a roughened, ulcerated surface. An uninterrupted recovery followed; food was begun on the second day, and solids could be taken in the second week without pain. He rapidly gained flesh and strength, and was well in 1903. Many other similar cases could be related.

I would lay particular stress on this class of

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cases, for I think it serves to explain some misconceptions about cancer generally. It would be easy for one to raise a claim to having cured a number of cases of cancer of the stomach by gastro-enterostomy; but I do not for a moment believe that any of these cases were more than inflammatory tumours formed around chronic gastric ulcers; nevertheless I have no doubt that they would have proved fatal just as certainly as if they had been cancer had no operation been done. This raises an interesting point, and that is the alleged increase of cancer, for I feel sure that many cases like those related above would have been certified as deaths from cancer of the stomach had no operation been done, or no necropsy and microscopic investigation made, and I think we must take such cases into account before hastily deciding that this disease is on the increase, though other evidence seems to prove the fact.

The cases also illustrate another point: even though a tumour be present, and even though it be probably too large for removal, it may be quite worth while advocating an exploration, to be followed up by gastro-enterostomy if that be practicable, in the hope that the disease may prove to be wholly or partly inflammatory, which the physiological rest secured by gastro-enterostomy will either cure or materially relieve.

To pass to the genuine cancer cases, what can we do for them when diagnosed at an early stage? This

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PLATE VI.

Cancer of cardiac end of stomach with dilated œsophagus.

(No. 2417, Royal College of Surgeons' Museum.)

Cancer of cardiac end of stomach, associated with cancer of the lower end of the œsophagus.

(No. 2421, Royal College of Surgeons' Museum.)

-ee p. 77.

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will depend: (1) on the position of the growth; (2) on its extent; (3) on the presence of adhesions; and (4) on glandular invasion or secondary growths.

First as to position. In irremovable growth at the cardiac end, if it involve the cardiac orifice and adjacent portion of the stomach, gastrostomy or jejunostomy should be performed in order that starvation may be staved off. The view that gastrostomy is both a dangerous and useless operation is, I know, held by some, but I feel convinced that such views are mistaken ones. When these cases, either of cancer of the cardiac end of the stomach or of the œsophagus, were handed over to the surgeon in a moribund condition, the mortality of gastrostomy was, of course, terrible, and the short survival of the cases, even if successful from an operative point of view, made the procedure almost useless, but when one can point to a series of gastrostomies performed since 1897, with only a 5 per cent. mortality and with great prolongation of life to many and alleviation of suffering to all, I feel that there are grounds for saying that the operation is well worth doing. The operation is quite a simple one, and if necessary can be performed under cocaine anæsthesia in a very short time. In several cases the patients have lived a year or more, and have gained considerably in weight, even up to 1½ st., and have lost their pain and the distressing sense of starvation.

The next class of cases is that in which the

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disease is even more extensive, involving a great part or the whole of the stomach, the disease being irremovable and gastro-enterostomy impracticable, and in which any attempt at taking food brings on pain and vomiting, so that the patient, unless relieved, must rapidly die in great distress; here a jejunostomy can be performed by a very simple and similar procedure to that of gastrostomy, and through a Jacques catheter sufficient food can be given to ward off starvation and relieve the pain caused by attempts at taking food by the mouth. This operation can be done through the small exploratory incision, and need involve very little longer time. It may prolong life for months or even for a year, and make the end much easier, and certainly less painful. I reported a case of jejunostomy in 1891 in which the patient lived three months, and in 1904 one that had lived twelve months after jejunostomy, and the fact of my case of almost complete gastrectomy being well over six years after operation and of the well-being of other complete gastrectomies shows, not only that the passage of food direct into the small intestine may be compatible with comfort, but that the digestive processes may be carried out completely. Although the operation of jejunostomy is rarely called for, it is one nevertheless which should be borne in mind, as in an appropriate case it may confer a great boon, and render tolerable an otherwise comfortless existence. The following is an example :

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Mrs. C—, aged forty-six years, the wife of a sea captain, was sent to see me on April 8th, 1904, when she was suffering great pain, which came on at frequent intervals, and she was vomiting five or six times a day; in fact, whenever she took food it was shortly vomited, the vomit being at times coffee-ground in character. A tumour in the epigastrium about the size of a large flat orange could be readily felt, and at short intervals the whole stomach became hard and rigid. No enlarged glands could be felt in the groin or above the clavicle. There was no tenderness on pressure, and the hard, nodular tumour was suggestive of cancer. Though she gave a history of indigestion and loss of health for eight years or even longer, the acute symptoms had only existed for six months.

On April 13th the abdomen was opened by a vertical incision through the inner margin of the right rectus, when the stomach was found to be involved in cancer from end to end, and as the glands along the lesser curvature were involved and others could be felt passing up through the opening in the diaphragm, and a number also in the great omentum, it was clearly impossible to perform gastrectomy and impracticable to do a gastro-enterostomy. A loop of jejunum was therefore brought up and short-circuited by suture over a decalcified bone bobbin, and a No. 12 Jacques catheter was inserted as described on page 206. The wound was rapidly closed and the

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patient was put to bed in good condition, the whole operation only having occupied half an hour or less. A meal of peptonised milk was given at once and repeated every two hours. From the time of operation the vomiting was never repeated, and she completely lost her pain. She returned home on the nineteenth day, having gained flesh and strength.

After the patient's return home, on May 17th, I received a letter to say: "Mrs. C— is doing wonderfully well. No pain or sickness, and taking as much food as she requires. She is very content, and is, I think, gaining flesh and strength, so that the result is even better than you had hoped for and much better than I ever expected. She is very grateful." She lived for a year, and during eleven out of the twelve months in comfort.

The third class of cases to be considered is where the disease involves the pylorus and is producing obstruction to the passage onwards of the gastric contents, but where, on account of the extreme feebleness of the patient or because of extensive adhesions, secondary growths, or involvement of glands, it is considered unwise to attempt pylorectomy or partial gastrectomy, though there is sufficient free stomach wall left to enable a gastro-enterostomy to be performed. In such cases a gastro-enterostomy, if performed with proper expedition and adequate precautions, affords the greatest relief to the sufferer, who not only loses the distress due to painful

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PLATE VII.

Colloid cancer of pylorus producing stenosis.
(No. 2426, Royal College of Surgeons' Museum.)

To face p. 80.

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peristalsis and to the irritation of retained secretion, but also becomes freed from the toxæmia due to absorption of the poisonous fermenting stomach contents, which are drained away into the intestine and there disposed of. Thus life is prolonged and made more comfortable, flesh and colour are regained, and even in cases of cancer the patient may have a new lease of life; in one of my cases the patient lived over two years. Moreover, in some cases where the condition of the patient and not simply the extent of the growth has prevented a radical operation the speedy restoration to health enables a radical operation to be subsequently undertaken. The following cases out of many others that could be cited serve to illustrate what I mean:

Case 1.—Mr. B—, aged sixty-two years. Symptoms for a year. Epigastric tumour noticed a month. No free HCl in vomit. Exploratory operation November 15th, 1900. Ring of cancer found, forming hour-glass-shaped stomach. Patient too ill for gastrectomy. Posterior gastro-enterostomy performed. Good recovery. December 20th, a month later, partial gastrectomy performed, the ring of growth being removed and the proximal and distal ends of the stomach being fixed together over a large bone bobbin. Good recovery; returned home within the month. Quite well a year later. Letter from Dr. G—, November, 1902, to say that Mr. B— had put on flesh, gained colour, and been able to take food

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well for over a year, but had succumbed to exhaustion from secondary growths in the omentum March 30th, 1902, about eighteen months after operation.

Case 2.—Miss B—, aged twenty-four years. Five years' history of stomach symptoms with great loss of flesh and recently coffee-ground vomit with tumour at epigastrium. Exploratory operation April 17th, 1902. Large tumour found involving the pylorus and anterior wall of the stomach. Enlarged glands rendered gastrectomy inadvisable. Posterior gastro-enterostomy performed. Good recovery and returned home on the nineteenth day. Seven months later Dr. W— wrote to say that the patient, who weighed 4 st. 5 lb. at the time of operation, on September 1st weighed 8 st. 1½ lb., thus nearly doubling her weight in five months, but that she had recently developed jaundice, possibly due to extension of the growth to the common bile-duct.

Case 3.—Mr. B—, aged thirty-six years, seen with a manifest tumour of the stomach October 26th, 1901, and with a history of stomach trouble extending over several years, with vomiting of blood and passage of melæna on two occasions within the preceding four months. At the operation a large tumour involving the duodenum and pyloric end of the stomach, too adherent for removal, was found and gastro-enterostomy performed. After the operation he went abroad and for six months he rapidly gained weight and felt very well. He then began to get

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thinner and lose strength, and without any pain he gradually lost strength and succumbed in September, 1902, eleven months after operation.

Case 4.—The patient was a married woman, aged thirty-seven years, who was seen with Dr. D—. Cancer of the body of the stomach and pylorus with dilatation was diagnosed. Gastro-enterostomy was performed on December 21st, 1899. She made a good recovery and was so well that gastrectomy was advised, but cancer of the uterus supervened and prevented further operation. She lived for nine months and was able to take ordinary food.

Case 5.—The patient, a man, aged sixty-three years, had had symptoms for five years, at first those of chronic ulcer, later those of malignant ulcer with tumour associated with hæmatemesis. Gastro-enterostomy was performed on March 22nd, 1901. He made a good recovery. He returned home at the end of the month and gained 4 lb. in weight during the fourth week. He ultimately gained about 2 st. and lived for a time in great comfort, but the growth progressed and he succumbed to exhaustion about a year later, having been able to enjoy life for some months.

Case 6.—Mr. W—, aged sixty-eight years, operated on July 18th, 1902, for pyloric tumour with dilatation of the stomach, the patient being extremely feeble and suffering great pain. The disease appeared to be cancer, and the glands were extensively involved so

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that gastro-enterostomy only could be performed. A letter from Dr. S— says: "Patient gained 10 lb. up to November, and is now 14 lb. heavier than before he fell ill last June. He is able to take regular exercise, and had never felt any pain after taking any meal whatever since the operation." He was well over three years later.

Other cases could be given, but these will suffice to show the beneficial effects of gastro-enterostomy even in advanced cases of cancer of the stomach, for, as will be seen immediately, it is only in the cases too advanced for removal that the short-circuiting operation should be performed.

The operation can be done with little risk, as including all my cases of posterior gastro-enterostomy for cancer performed during the past ten years the mortality is only 3·4 per cent.—a great contrast to the death rate of these cases a few years ago.

The remaining class of cases is of great interest, and includes those where the disease is limited to the stomach, and where the lymphatic glands and adjoining organs have not been seriously invaded, the patient being in a sufficiently good condition to permit of the radical operation of gastrectomy being done. The following are examples:

Mrs. J—, aged fifty years. Symptoms five months: tumour noticed three weeks. Operation January 31st, 1901. Tumour found involving the whole circumference of the pyloric end of the stomach a

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short distance from the pylorus. After the growth had been widely excised the distal and proximal ends of the stomach were brought together over a large bone bobbin. Glands were excised from the lesser and also from the greater omentum. Smooth recovery. On January 4th, 1903, two years later, Dr. F— was kind enough to write and tell me that the patient was remarkably well. She remained well until 1905, when there were signs of recurrence.

Mrs. S—, aged fifty-four years. Loss of flesh and pain with failing health for eight months; slight jaundice and tumour in epigastrium, also right hypochondrium for a shorter period. Operation August 9th, 1900. The gall-bladder, containing gall-stones, and the site of the tumour was removed. As the adjoining portion of the liver was involved, a wedge-shaped partial hepatectomy was performed, and as the pylorus was also the site of growth a partial gastrectomy including the pylorus was done, the cut section of stomach being united to the duodenum by two continuous sutures over a bone bobbin. The removed tumour examined microscopically after operation proved to be cancer. That part of the abdominal wall to which the tumour had been adherent was also excised. She was reported well in 1906.

Mr. A—, middle-aged, who had been ailing for a year, and had had stomach symptoms for three months and a noticeable tumour for six weeks, was

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supposed to be too ill and anæmic for operation, but as the tumour which was situated in the left hypochondrium and epigastrium was freely movable I decided to operate. On May 23rd, 1902, I found a mass of cancer involving the centre of the stomach, which I removed along with some glands adjoining it. Recovery was uninterrupted. A letter dated January 22nd, 1903, from Dr. M—, states: "Patient very well, has gained 14 lb. in weight. No evidence of return of growth. Able to transact his business." The patient lived until 1905, when he had recurrence of the disease and died some months later.

In 1902 I reported a case *in extenso* where I had removed the whole of the stomach, except a small portion of the dome adjoining the œsophagus, for malignant disease on March 18th, 1901. I am glad to say that this patient, over six years later, remains in absolutely good health; he has a good appetite, enjoys his food, and is able to attend to his business as usual. The following are notes of the case:

Mr. —, aged thirty-eight years, was sent to me on March 18th, 1901, by Dr. R. O. Petrie, with the following history:

He had since childhood always complained of flatulence and had suffered from indigestion, though he had only been ill for two years, during which time he had suffered from fatigue, with some loss of strength but no pain. Six months ago he began to have pain every morning, which started in the epi-

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gastrium and passed over to the right side of the abdomen. There was no pain immediately after food, but it always came on before the next meal, when food gave relief. He vomited for the first time the week before seeing me. At that time he had an attack of diarrhœa which was thought to be due to a chill. He had never been constipated. There had been great loss of flesh during the past twelve months, amounting to 2 st., his weight when seeing me being 9 st. 1 lb. He looked ill and cachectic. He was quite sure that he had never vomited blood and that he had never seen blood on the motions.

On examining the abdomen a tumour could be easily seen and felt, occupying the epigastric region, and extending from the left costal margin nearly as far as the right. On distending the stomach with air the tumour was pushed downwards, but there did not seem to be much dilatation. The tumour had a wide range of mobility, could be made to pass to the right and left side of the abdomen, and could be pushed up under cover of the liver and down below the margin of the ribs. During manipulation the tumour hardened under the hand, when it was very distinct, but when the stomach muscle was relaxed the growth was less prominent. There was no free HCl in the stomach contents. An operation was proposed and consented to, and in the presence of Dr. Petrie I opened the abdomen by an incision

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through the right rectus. The tumour at once came into view, and proved to be a firm, nodular, malignant growth involving nearly the whole of the stomach from the pylorus to the œsophagus, the only portion of the organ apparently free being a little of the dome near the left of the œsophageal opening. There was no ascites, and no enlarged glands could be felt, nor could any secondary growths be seen.

As it was clearly useless to perform any lesser operation, and as the tumour was so mobile, gastrectomy was decided on.

The duodenum an inch beyond the pylorus was clamped by long forceps covered with rubber tubing, the lesser and then the greater omenta were divided between ligatures, and as there were no adhesions the large tumour was then drawn down, and the œsophagus and dome of the stomach were clamped by two forceps applied from the left and right side respectively. The stomach was then cut away by scissors, and after all visible vessels had been ligatured the clamps were released and a few other bleeding points taken up; but throughout very little blood was lost. The duodenum was brought across the spine and fixed by an external celluloid thread and an internal catgut suture around a decalcified bone bobbin to the margin of the stomach remaining around the œsophageal opening. The duodenum and cardiac end of the stomach seemed to hold together with very little tension. The opera-

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tion had been effected without soiling the peritoneal cavity, as the parts had been isolated throughout by sterilised gauze. The abdomen was closed in layers by means of continuous catgut sutures, and the patient was returned to bed in very good condition.

He was allowed to take a little liquid nourishment with plasmon after twenty-four hours, and, after a week, light custard pudding. Nourishment of more consistency was then given, and within the month he was taking minced meat and other ordinary foods. A breaking-down hæmatoma at the week end delayed healing for a fortnight, but otherwise recovery was uninterrupted, and he was able to return home before the end of April.

On August 27th I received a letter from Dr. Petrie to say: "Mr. — continues well; I saw him to-day and he has become considerably stouter."

In November, 1901, he called to see me, and I failed to recognise him: he looked healthy and fat, and seemed to be vigorous and well. He had gained 2 st. in weight. He said that his digestion was very good if he did not attempt too large a meal. He gave the following as his ordinary diet chart.

7 a.m.—Breakfast cup of boiled milk and one table-spoonful of brandy.

Breakfast.—One egg boiled, or a little bacon, bread and butter, one cup of tea.

11 a.m.—Breakfast cup of boiled milk with one table-spoonful of plasmon.

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Dinner.—Varying as follows: Lean of a mutton chop, little fish, chicken, or pigeon, with a little cauliflower and bread, always milk pudding, chiefly rice.

3 p.m.—Breakfast cup of boiled milk and one tea-spoonful of plasmon.

Tea.—Bread and butter or a little toast, one cup of tea.

8 p.m.—Cup of milk and one tea-spoonful of plasmon.

Supper.—Nearly one pint of boiled milk and bread.

In 1906, over five years after operation, he was seen by the matron of the surgical home where he stayed, and she reported him as looking in robust health and of normal weight. He was again reported well in 1907.

The tumour removed was a nodular, softish growth, involving almost the whole of the stomach, including the pylorus and extending from it to the cardiac end, where a small margin of healthy stomach wall remained. It weighed 1 lb. immediately after operation. Unfortunately the specimen, which was sent to a pathological laboratory to be mounted and reported on, was mislaid and cannot be found. It is impossible, therefore, for me to say whether it was sarcoma or cancer, but from the absence of enlarged glands, from the rapidity of growth and from its freedom from adhesions I suspect that the growth was a sarcoma.

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It was undoubtedly malignant and was invading the stomach walls generally; the growth was breaking down on its visceral aspect, and the stomach cavity contained some grumous material thrown off from the growth. The pylorus was invaded, but the line of section in the duodenum and at the cardiac end of the stomach showed a healthy appearance, and a free portion existed between the growth and the cut margin.

These cases out of others that I could relate will be sufficient to show that removal of even a considerable portion of the stomach may be something more than a palliative operation, and I think it justifies me in saying that although it is better to have cases of cancer diagnosed and operated on early, yet we need not take the pessimistic view which has been given by some surgeons that if a tumour be manifest it is too late to perform a radical operation.

I hope I have advanced sufficient evidence to prove:

(1) How desirable it is to make an early diagnosis of cancer of the stomach in order that a radical operation may be performed at the earliest possible moment.

(2) That it may be needful to perform an exploratory operation in order to complete or confirm the diagnosis.

(3) That such an exploration may be done with little or no risk in the early stages of the disease.

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(4) That even where the disease is more advanced and a tumour perceptible, an exploratory operation is, as a rule, still advisable in order to carry out radical or palliative treatment.

(5) That where the disease is too extensive for any radical operation to be done the palliative operation of gastro-enterostomy, which can be done with very small risk, may considerably prolong life and make the remainder of it much more comfortable and happy.

(6) That some cases, thought at the time to be cancer too extensive for removal, may after gastro-enterostomy clear up completely and get quite well.

(7) That in cases of disease of the cardiac end of the stomach too extensive for removal the operation of gastrostomy may considerably prolong life and prove of great comfort to the patient by preventing death from starvation.

(8) That even where the disease is too extensive either for removal, or for a gastro-enterostomy or even a gastrostomy being performed with a fair chance of success, the operation of jejunostomy may prove of service to the patient.

(9) That where a radical operation can be performed, the thorough removal of the disease may bring about as much relief to the patient as does the operation for removal of cancer of the breast, uterus, and other organs of the body, and that in some cases a complete cure may follow.

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PLATE VIII.

Cancer of pylorus, producing stenosis, in a woman aged thirty-six.
(No. 2411*a*, Royal College of Surgeons' Museum.)

Hour-glass stomach, possibly congenital, with growth round cardiac orifice.
(No. 2416, Royal College of Surgeons' Museum.)

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CHAPTER V

SIMPLE TUMOURS OF THE STOMACH THAT MAY BE MISTAKEN FOR CANCER

Benign tumours of the stomach are rare, and unless they invade the orifices may produce no symptoms, though when ulcerating they may simulate malignant disease.

Tumours of the stomach caused by chronic ulceration.—It may be possible for a considerable tumour to develop around a chronic gastric ulcer and to simulate cancer, both in its physical signs and symptoms. As a rule the length of time during which the symptoms have continued will give rise to a suspicion of ulcer, but on the other hand cancer is well known to be predisposed to by ulcer, and in such cases the presence of a well-marked tumour cannot but fail to give rise to a suspicion of cancer.

The presence of free hydrochloric acid in the vomit or in the lavage after a test meal, though in favour of ulcer, is no certain guide, for it is well known that in ulcus carcinomatosum the vomit contains an excess of free HCl.

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On several such cases I have operated and performed a gastro-enterostomy on finding the disease too extensive for removal; but the complete recovery of the patients and a return to perfect health have shown that the disease must have been simple.

On two occasions I have performed partial gastrectomy for what appeared to be cancer, and only on microscopic investigation has the disease been found to be simple. On one occasion I found a large tumour of the cardiac end of the stomach which I could not remove. The abdomen was closed and a bad prognosis given, but the patient recovered and is well some years later.

The points that may help in the diagnosis are the duration of the disease and the great pain and tenderness in ulcer. Even when the abdomen is opened it is not always easy to differentiate the two diseases, but the absence of nodules on the growth and of secondary nodules in the omentum together with the presence of discrete, though enlarged, lymph-glands, may be of some help, though in certain cases the only way to decide is by the microscope.

Plastic linitis.—The term "plastic linitis" has been used somewhat indefinitely to indicate a chronic induration and thickening of the walls of the stomach with a marked diminution of the gastric cavity.

It is an extremely rare condition that would be seldom described if all cases of diffuse sarcoma or carcinoma of the stomach walls could be excluded.

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The following example, in which a very atypical epithelioma is said to have been found, but which otherwise corresponds to the condition under consideration, serves to illustrate the indefinite character of the affection:

Gayet and Patel: Total gastrectomy for plastic linitis (*Arch. Gener. de Med.*, 81st year, vol. i, p. 770).—In this case the patient, a woman, aged forty-four years, was operated on for gastric cancer infiltrating the entire walls of the stomach. Professor Jaboulay performed gastrectomy. An analysis of the gastric contents previous to operation had given total acidity 1·93, HCl 1·13; no free HCl; no lactic acid. At the operation no enlarged lymphatic glands were found after gastrectomy; the duodenum was closed and a loop of the jejunum was brought up to a small piece of the cardiac end of the stomach which had been left. On microscopical examination, after many sections had been made it was found that the lesion was a very atypical epithelioma originating in a chronic inflammation. The inflammation showed nothing specific and there was nothing to suggest tuberculosis, no giant cells, no disintegration, no glands.

Roux (*Rev. Med. de la Suisse Romande*, January 20th, 1905) reports the following case: A coachman, aged thirty-three years, was admitted to hospital on June 24th, 1901. He had been in good health until September, 1900, when he began to suffer from

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gastric distension immediately after food, acid eructations, and a sensation as though the passage of food were obstructed. Appetite was good. A stay in his native country produced great, though temporary, improvement, but on January 15th, 1901, he began to vomit after each meal. If food were retained for any time it produced a sensation of gastric oppression, which was relieved when vomiting occurred. The returned food was undigested. He became greatly emaciated, though his appetite remained excellent. There was no melæna, and neither hæmatemesis nor pyrosis. The hæmoglobin was 75 per cent., and the red lips contrasted with the pallor of the skin. The abdomen was retracted. It was difficult to palpate the epigastrium on account of rigidity of the recti muscles, especially on the right side. Traube's semilunar space was extremely tympanitic. After a test meal the total acidity of the gastric juice was 4·6 per mille. Free HCl was absent, and there was much lactic acid. On inflation the outlines of the stomach were not visible. A diffuse, inoperable tumour was suspected. Laparotomy was performed on June 26th, 1901. The stomach was small and rigid, and the pyloric portion was grooved by a number of irregularly-placed circular indentations, which resembled those on certain Bologna sausages. It was hard, and appeared to be solid, though a stomach-tube could be felt indistinctly to be arrested at about the middle

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indentation. The superior (cardiac) half of the stomach, though less indurated, was extremely thickened. Total gastrectomy was precluded by the condition of the walls and the numerous adhesions about the cardiac end. Anterior gastro-enterostomy appeared to offer the best chances, and to be the only possible procedure. The peritoneal coat was thin. The muscular coat, however, was more than 1 cm. in thickness at its thinnest part. It was friable, of a colour resembling chamois leather, and traversed by dense whitish strands of connective tissue. In places there were yellow, fatty patches. On opening the mucosa a greenish, bilious fluid, which contained remnants of food and a cherry-stone swallowed three or four days previously, escaped. The mucosa was blackish, hæmorrhagic, smooth and friable, and appeared to be superficially ulcerated. The introduction of a finger revealed that the interior of the stomach presented no trace of the circular folds present on the surface. Towards the pylorus the finger completely filled the lumen. Owing to the mobility and looseness of the mucous membrane of the coil of jejunum selected, there was no difficulty in approximating the mucous membranes. The opening after completion of the sutures easily admitted two fingers. After the operation there was great collapse, but with the constant hypodermic adminstration of stimulants, etc., the man rallied. On July 11th the wound had healed and on August

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2nd he was discharged, having gained more than 11 lb. He was in good health in the spring of 1904.

In true plastic linitis there is no evidence of new growth, the thickening being due to hypertrophy of the muscular coat and infiltration of the wall of the stomach with inflammatory exudation, which in places has been converted into fibrous tissue. An almost similar appearance may be produced by cancer as in the so-called "leather-bottle stomach," of which a photograph from the Royal College of Surgeons Museum furnishes a good example (Plate IV, p. 63).

The symptoms are those of chronic gastric irritation associated with epigastric pain, tenderness and vomiting. Emaciation occurs as the result of inability to take or retain food. A hard tumour in the epigastrium extending under the left costal margin is suggestive of carcinoma, though the tenderness of the epigastrium and the rigidity of the recti point to inflammation rather than growth.

Even in the absence of new growth, free HCl may not be found, as in Roux's case. Owing to the presence of perigastritis numerous adhesions may be found.

Treatment.—Medical treatment in the shape of careful dieting, rest, and sedatives will have usually been tried before the surgeon sees the case. In plastic linitis surgical treatment is called for.

If there is reason to believe that cancer or sarcoma are not causing the trouble, a well-planned

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PLATE IX.

Villous growth near lesser curvature, found post mortem in an aged woman.

(No. 2407*a*, Royal College of Surgeons' Museum.)

Polypus near pylorus, which caused death by vomiting.

The patient was a woman aged ninety-two. (No. 2405*d*, Royal College of Surgeons' Museum.)

To face p. 99. *Adlard & Son, Impr.*

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gastro-enterostomy, as in Roux's case, offers a good chance of relief or cure.

If, however, there is a suspicion of the disease being malignant, complete gastrectomy is advisable, especially if the organ is found to be free from complex adhesions and the lower end of the œsophagus can be dragged down sufficiently to render approximation of the duodenum or jejunum possible.

An œsophageal bougie introduced into the stomach through the œsophagus renders dissection of the cardiac end of the stomach from the gullet easier, and it also facilitates the process of suturing the opening in the œsophagus to the opening in the bowel.

If the patient's condition or the anatomical arrangements of the parts renders either gastro-enterostomy or gastrectomy impracticable, the operation of jejunostomy will enable the patient to be fed artificially, and by giving rest to the stomach may so far alleviate the symptoms of irritation as to enable food to be again taken by the mouth after a little time.

Adenoma.—Simple glandular tumours of the stomach may be single or multiple, and they are specially liable to form polypi. They may be found in any part of the stomach, but are not infrequently found to occur at the pyloric end, where they may give rise to pyloric obstruction and dilatation of the stomach.

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In a case of my own, a sessile adenoma gave rise to pyloric obstruction with gastric dilatation, which was cured by removal of the growth, the longitudinal incision being afterwards stitched up transversely as in the ordinary operation of pyloroplasty. In another case under the care of a colleague a pedunculated adenoma the size of a cherry acting like a ball-valve produced similar symptoms, which were cured by its removal.

When the tumour is large it may form a freely-movable epigastric tumour as in a case reported by Sutton, and in another reported by Dr. Hinds.

The symptoms may resemble those of cancer by inducing coffee-ground vomiting and wasting as in a case reported by Chaput at the Société de Chirurgie, in Paris, 1894. The patient was a man, aged sixty-four years. The symptoms were chiefly emaciation and vomiting of coffee-ground material, and an epigastric tumour was observed. At the operation an adenoma covered with normal mucous membrane was found attached by a small pedicle to the posterior wall of the stomach.

Adenoma may pass on into carcinoma or be associated with it, as in a specimen now in the Leeds Museum.

Hayem described two cases in which the growth resembled Brunner's glands.

Ebstein collected twenty-four cases of mucous polypi, fifteen in men and eight in women, in one

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PLATE X.

Polypi growing from the mucous membrane of the stomach of a gentleman, seventy-six years of age, who suffered from constant dyspepsia.

(No. 2405, Royal College of Surgeons' Museum.)

Polypus near pylorus which caused fatal intussusception of duodenum in a man aged twenty-one.

(No. 2405*c*, Royal College of Surgeons' Museum.)

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the sex not being mentioned. He stated that the frequency of these tumours increases after forty years of age; in one half the tumours were solitary, in the rest multiple, even up to 200 in number.

The mucous membrane over them may be smooth or villous.

Treatment.—When adenoma is polypoid it should be removed and the pedicle ligatured. If forming a sessile tumour it should be freely excised and the healthy edges of mucous membrane and stomach wall brought together by suture.

If the pylorus be invaded by a sessile adenoma the growth should be freely excised and a gastro-enterostomy performed, but if the deeper layers of the stomach wall are invaded, pylorectomy or partial gastrectomy should be performed.

Lymphadenoma.—This is a rare form of tumour characterised by the appearance of multiple polypoid projections into the cavity of the stomach.

Pitt (2) stated that he had only been able to find seventeen cases recorded in literature.

The neoplasm usually arises in the mucous membrane or in the submucosa, but it may arise in the serous coat of the stomach.

In the special case reported by Pitt the disease was evidently malignant and had invaded other viscera.

In a case reported by Normans (3) symptoms were

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absent, although the mucous membrane of the stomach was everywhere covered by dendriform projections and wart-like growths.

The projections may ulcerate and give rise to severe hæmatemesis.

In the cases recorded by Cornil and Ranvier (11) the tumours formed in the deep mucosa or in the submucosa and sent prolongations into the outer coats of the stomach. This condition is practically only of pathological interest.

Myoma.—Tumours resembling uterine myomata histologically may spring from the muscular coat of the stomach and push the mucous membrane before them, projecting into the stomach as sessile or polypoid tumours, or pressing towards the serous surface they may project into the abdomen and form immense tumours, as in von Erlach's case, in which a tumour weighing 5½ kilogrammes was removed successfully from the anterior wall of the stomach (4) and in von Eiselberg's case, in which a fibro-myoma the size of a man's head was successfully removed from the greater curvature of the stomach.

Of nineteen cases reported, eleven were external, six internal, and in two details are not given.

If occurring near the pylorus, obstruction may be produced as in Herhold's (5) case, or they may ulcerate and give rise to hæmatemesis.

The treatment of these tumours is by removal, and as they are benign it is unnecessary to take away

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more of the wall of the stomach than necessary for removal of the tumour.

Lipoma.—Lipomata in the stomach wall are extremely rare; they may arise from the submucous tissue and project into the cavity of the stomach, or from the subserous coat and project into the peritoneal cavity.

In Virchow's work (*Die Krankhaft. Geschwulste*) is figured a lipoma arising in the submucous tissues near the pylorus.

If diagnosed, these tumours can be readily removed by enucleation.

A case of lipo-myoma has been reported by Kunze (6), who removed it from a man aged fifty-two years, it having been diagnosed as a mesenteric tumour.

Cysts.—Small cysts from obstruction of gland ducts are not uncommon. Ruysch (7) described a gastric dermoid cyst containing hair. Engel Reimers described a multilocular lymphangioma of the stomach wall occurring beneath a chronic gastric ulcer of the lesser curvature (*ibid.*). Albers mentions a cyst $2\frac{1}{2}$ in. long on the lesser curvature of the stomach in a child. Ziegler performed laparotomy for a cyst of the stomach following injury; it formed a tumour for which the operation was undertaken, and after emptying the cyst it did not refill.

Mr. Jonathan Hutchinson (8) described a cystic tumour the size and shape of a walnut, situated near the pylorus between the muscular and mucous coats.

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Anderson (9) described multiple cysts of the stomach and intestines which he believed originated from inclusion or embryonal rests after the manner of dermoids.

H. Read (10) described a case of a man, aged sixty-two years, who died after an illness of five weeks, and at autopsy a cyst was found completely encircling the stomach. It contained clear fluid and a fatty substance with black streaks of extravasated blood.

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CHAPTER VI

SARCOMA OF THE STOMACH

PRIMARY gastric sarcoma is not so rare as it is generally thought to be. It is probable that a number of cases described as cancer have been truly sarcoma; this we may conclude from the fact that a number of museum specimens classed as cancer have on microscopic examination proved to be sarcoma.

Fenwick (5) stated in November, 1900, that out of sixty recorded cases, fifty-three at least ought to be regarded as genuine, and he thought that they constituted from 5 to 8 per cent. of all primary neoplasms of the stomach.

The recognised varieties are round-celled, spindle-celled, myo-sarcoma, and angio-sarcoma.

Round-celled sarcoma constitutes 62 per cent. of all the recorded cases. It occurs as a rule as a dense infiltration of the pyloric third of the stomach, and, unlike cancer, tends to render the pylorus patulous, though in some cases the thickening leads to partial stenosis. In about one sixth of the cases the growth involves the entire stomach, invading both œsophagus

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and duodenum. The mucous membrane presents signs of chronic inflammation and ulceration. In only two of Fenwick's cases was there a circumscribed tumour with secondary nodules in the surrounding mucous membrane. These growths have a tendency to soften and break down.

In a case of round-celled sarcoma, Schopf (1) removed a tumour the size of a child's head, leaving the cardiac and pyloric ends of the stomach, which he sutured together. The patient was alive twelve months later.

Spindle-celled sarcoma constituted 22 per cent. of the fifty-three cases. It presents itself usually as a round or circumscribed tumour in the neighbourhood of the greater curvature, and tends to project towards the serous coat, ultimately forming a very large tumour, sometimes becoming pedunculated. The size attained may be enormous, so as to fill the whole of the abdomen.

Billroth successfully removed a cystic sarcoma of this variety. Cantwell (2) removed one weighing 12 lb., but it recurred eight months later.

Myo-sarcoma.—Five out of fifty-three recorded cases were of this variety. They form smooth or slightly nodular tumours, and usually occur near the greater curvature. They may attain an enormous size, Brodowski having met with one of 12 lb. They are apt to undergo cystic degeneration and to be accompanied by severe hæmorrhage.

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Angio-sarcoma.—Two cases have been recorded. In one case the tumour was the size of a child's head; it contained many cysts due to hæmorrhage. Kosinski (3) successfully removed a tumour of this kind.

Symptoms.—Sarcoma of the stomach may occur at any time of life, from infancy to extreme old age. The symptoms are similar to those of carcinoma—progressive loss of flesh with debility and anæmia. Pain is usually present. Pyrexia slight, but persistent. Albumen in the urine may be present. Hæmatemesis is apt to occur and may be so free as to cause death. Free HCl is usually absent and lactic acid present as in cancer. The small round-celled sarcoma resembles cancer in all respects except in less frequently leading to stenosis; but in spindle-celled sarcoma gastric symptoms may be entirely absent, and when operative treatment is undertaken in a rapidly-growing tumour the growth may be discovered unexpectedly to be arising from the stomach. Perforation is apt to occur in round-celled sarcoma in from 10 to 12 per cent. of all cases. Metastases in glands, in distant organs, and especially in the skin, are prone to occur. According to Kundrat, the tonsils are apt to enlarge and the follicles on the side of the tongue to become swollen and ulcerated.

The prognosis varies with the nature of the growth; in round-celled sarcoma the average duration of life is fifteen months; in spindle-celled sarcoma and

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myo-sarcoma the average is two years and eight months.

Treatment.—Surgical treatment of gastric sarcoma has met with considerable success so far as the immediate effect of operation is concerned. The solid tumours are especially favourable for extirpation, especially when pedunculated, but in all cases it is desirable to remove the portion of stomach wall from which they spring very freely.

In the round-celled variety a wide removal of the stomach by partial or complete gastrectomy is required in order to give any hope of success. Török, Dock, Schopf, and others have removed considerable tumours, and in Schopf's case the patient was living a year later.

Early diagnosis and early thorough surgical treatment must be the great aims in the treatment of sarcoma.

Statistics.—Lecene and Petit (4) report ten deaths out of twenty-four collected cases, but only one out of seven proved fatal, where the resection of the gastric walls was around a circumscribed tumour.

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CHAPTER VII

DILATATION OF THE STOMACH

DILATATION of the stomach may be acute or chronic. The acute condition constitutes a distinct disease, and is seldom if ever associated with cancer of the organ.

Chronic dilatation may be obstructive or atonic. As a sequence of cancer of the pylorus or pyloric end of the stomach obstructive dilatation is quite of common occurence, and calls for treatment, whereas simple atonic dilatation, though sometimes associated with cancer, seldom calls for surgical treatment.

Obstructive dilatation.—Although dilatation of the stomach has been recognised for centuries as a pathological entity, its full importance was not appreciated until the latter fourth of the nineteenth century, when Kussmaul and his pupils began to consider the effects of obstruction on the functions of digestion.

The causes of mechanical dilatation of the stomach are usually at or near the pylorus or in the duodenum, and may be due to malignant or non-malignant disease. They are:

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(*a*) Cancer of the pylorus.

(*b*) Cancer of the duodenum.

(*c*) Rarely sarcoma of the pylorus or duodenum.

(*d*) Cancer of the body of the stomach leading to hour-glass stricture and dilatation of the cardiac portion of the stomach.

Other causes leading to dilatation of the stomach, and which may be therefore important from a diagnostic point of view, are :

(*a*) Stenosis of the pylorus due to contraction of a simple ulcer.

(*b*) Hour-glass stricture of the stomach from contraction due to simple ulcer, leading to dilatation of the cardiac pouch.

(*c*) Perigastritis, leading to stricture or to kink of the pylorus.

(*d*) Hypertrophy of the pylorus with fibroid thickening, occasionally seen in adults, but more frequently found in infants, when it is known as "congenital hypertrophic stenosis."

(*e*) Pyloric spasm, a sequel of gastric ulcer, which may continue long after the ulcer has healed. Spasm of the pylorus is also a symptom of severe hyperchlorhydria, when it is known as Reichmann's disease.

(*f*) Polypus at the pyloric end of the stomach.

(*g*) Tumour outside the pylorus pressing on and obstructing it.

(*h*) Pressure on the duodenum by an abnormal

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enlargemeut of the pancreas, as when the inflamed head of the pancreas embraces the duodenum, or when growth of the pancreas invades it.

(*i*) Pressure by the mesenteric vessels as they cross the duodenum.

(*j*) Cholelithiasis producing ulceration and inflammatory thickening of the pylorus and first part of the duodenum.

(*k*) Kink of the pylorus due to the dragging by a movable right kidney.

(*l*) Kink of the pylorus due to gastroptosis.

Diagnosis.—The diagnosis of cancer from other conditions leading to dilatation is fully considered in the chapter dealing with diagnosis generally.

Symptoms.—The first effect of stenosis when not sufficient to produce complete obstruction is to cause increased peristalsis in order to overcome the obstruction. When the health is otherwise good this compensatory hypertrophy enables a moderate degree of obstruction to be overcome. As soon, however, as compensation fails, retention of food and of the gastric secretion takes place. Fermentation of the retained contents then follows, leading to sub-acute gastritis or catarrh, the first result of which is to weaken the muscular wall of the stomach. For a time relief may be obtained by vomiting, which takes place at irregular intervals. Early in the history of dilatation vomiting may only occur every second or third day, but as the obstruction increases it occurs

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daily, and ultimately may take place after every meal. As the result of these pathological changes wasting occurs, and as less and less fluid becomes absorbed from the diseased stomach there is great thirst, increasing constipation, and diminished excretion of urine; and when the obstruction finally becomes complete death occurs from starvation.

According to the extent of the ulceration and the amount of cicatricial contraction the symptoms may be hastened or delayed, so that in some cases months or even years may pass before the final stage is reached if the disease be simple; but it must be borne in mind that cancer may be grafted on chronic ulcer. The length of time that symptoms have been present does not, therefore, exclude the possibility of cancer.

The various forms of pyloric obstruction mentioned under the different causes do not all pursue so slow a course. For instance, the inflammation dependent on pyloric or duodenal ulcer may be so acute as to cause great swelling that may rather acutely block the outlet of the stomach, and the supervention of spasm may lead to an acute exacerbation of symptoms previously chronic.

In considering the clinical history, it is necessary therefore to take into consideration the cause of the stenosis, and secondly the symptom due to dilatation *per se*.

After an ordinary meal the stomach should be

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found empty in about six or seven hours. If the motor functions of the stomach are impaired the remains of food will be found later than this: for instance, when the dilatation is well marked and the stomach is washed out early in the morning, the remains of the supper of the previous evening may be found in it. If the obstruction is not complete, and there is a certain amount of muscular power in the gastric walls, the patient may only complain of a sense of weight and discomfort in the epigastrium, and of flatulency. In well-marked cases visible peristalsis from left to right is seen—a symptom which is almost pathognomonic of mechanical obstruction, and in such cases vomiting will almost certainly be a prominent symptom. The vomit in obstructive dilatation is quite characteristic, in that it is large in amount and characterised by the presence of well-marked fermentation. It may contain particles of food that have been taken days before. If allowed to stand the vomit will usually separate into three layers, a sediment consisting of solid particles of food, a central layer of dirty greyish fluid, and a scum of frothy fermenting material, in which will be found yeast cells and sarcinæ. In quite a number of cases of gastrectasis from simple pyloric stenosis, tetany in a greater or less degree is a marked symptom, which may even lead to a fatal issue. A physical examination before the stomach has emptied itself will usually yield a well-marked succussion

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splash, and on distending the stomach with carbonic acid gas or air, gastric resonance may be found in severe gastrectasis to reach to the pelvis; but even when the dilatation is only moderate in extent the stomach will usually reach well below the umbilicus.

In rare cases of simple stenosis, a tumour may be felt, but, as a rule, in stenosis from ulcer, the pylorus is fixed by adhesions under cover of the liver, and unless the thickening is considerable it is difficult to discover any tumour on palpation. A palpable tumour, especially if it be freely movable, is more likely to be due to cancer than ulcer, though this rule is not absolute.

Hyperchlorhydria is usually present in simple cicatrical stenosis, though if the dilatation has existed for a long time the peptic glands may be seriously damaged and free HCl may be absent, as it usually is in malignant disease.

Where there is a chronic ulcer, blood may be found on microscopic examination, but coffee-ground vomiting is less characteristic of this form of stenosis than when the dilatation is dependent on cancer.

Pain is usually present at some stage of the disease. It may vary with the cause: for instance, if from ulcer at the pylorus it usually occurs two to three hours after a meal, and may be relieved by food in the earlier stages; if from cancer there may be little pain for a time; but as the disease progresses, painful peristalsis may occur at irregular intervals and may be increased by food.

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When the dilatation becomes extreme there may be merely a sense of weight and fulness due to the accumulation of food, secretions, and flatus, which may be relieved by vomiting or by lavage of the stomach.

The final stages are characterised by subnormal temperature, coldness and lividity of the extremities, and extreme loss of strength, ending in death from exhaustion.

Treatment.—In the early stages of obstructive dilatation when the symptoms are slight, relief for a time will, doubtless, have been given by lavage of the stomach and the observance of a strict diet; but as soon as the symptoms are pronounced it is a mere waste of time to persevere with the use of drugs, massage, electricity, or even lavage, except in those rare cases where the stenosis is due either to syphilitic ulcer or gumma, which should speedily respond to specific treatment.

Surgical treatment is alone of avail in order to remove the cause of the stenosis or to create a new channel by which the stomach contents may pass onwards into the intestines.

It may sometimes be possible to remove the cause of the stenosis by division of peritoneal bands or adhesions, or the removal of a tumour obstructing the pylorus, but in the majority of cases of cancer it will be necessary either to do a partial gastrectomy or to perform a gastro-enterostomy.

Pylorectomy or partial gastrectomy is a much

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more severe procedure than gastro-enterostomy, but there is a certain class of cases in which it is difficult to say whether the disease is simple or malignant. If malignant, partial gastrectomy including the pyloric orifice should certainly be performed if the disease is not too extensively involving the lymph-glands or associated with secondary growths.

If the obstruction of the pylorus is associated with a tumour due to inflammatory disease, in all probability it will be so adherent to the under surface of the liver or to the pancreas that pylorectomy will be extremely difficult and hazardous. In such cases it will probably be deemed necessary to rest content with gastro-enterostomy in the hope that the rest induced by the operation will cause a subsidence of the tumour. I have found this to apply in many such cases in which at the time there was a question of malignant disease.

If, however, under these circumstances the tumour should be free from adhesions and the disease limited to the neighbourhood of the pylorus, it may be quite justifiable to perform pylorectomy in case of doubt.

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CHAPTER VIII

OPERATIONS FOR GASTRIC CANCER

(1) Simple exploratory incision.
(2) Gastrectomy. (*a*) Partial.
(*b*) Complete.
(3) Gastro-enterostomy.
(4) Gastrostomy.
(5) Jejunostomy.

Exploratory incision.—Although exploratory incision for the purpose of making a diagnosis is, as a rule, undesirable, in certain cases the operation is not only justifiable but strongly to be urged. Whenever cancer of the stomach is suspected and the diagnosis cannot be verified by ordinary methods, an exploratory operation should be urged, for it has been clearly proved that in the surgical treatment of cancer the earlier an operation can be performed the greater will be the chance of radical cure, whereas if a diagnosis of the disease be not made until a tumour can be felt by palpation, it is, as a rule, too late for radical treatment.

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An exploratory operation may also be required in certain cases of palpable tumour of the stomach in which it is just possible that the growth may be amenable to surgical treatment, but where it cannot be said beforehand whether the lymphatic glands are too extensively involved, or the disease has so far invaded the adjoining tissues that removal of the growth would be useless, when a gastro-enterostomy or a jejunostomy may have to be performed as palliative procedures.

In some other diseases and injuries of the stomach it is found impossible to say what operation or operations may be required before the abdomen is opened and the extent and nature of the disease ascertained by inspection and palpation. Every operation on the stomach therefore, in this sense, is an exploratory procedure, and the surgeon must be prepared to adapt himself to circumstances when he sees the nature and extent of the disease.

Operation.—If there is time to prepare the patient it is desirable that the condition of the mouth should be attended to, and that aseptic foods should be given for forty-eight hours before operation. To this end I am accustomed to recommend patients to wash their teeth with a 1 per cent. solution of carbolic acid several times daily for two days before operation. I also direct that nothing but food that can be sterilised by boiling or cooking should be given, and that the plates on which it is served, and the utensils

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used, should all be sterilised by boiling water before use.

Except in cases of marked retention of the stomach contents I am not accustomed to have the stomach washed out before operation, unless the patient has been accustomed to it, and can submit to it without inconvenience; but if there is retention of the stomach contents, as in many cases of pyloric stenosis, I sometimes have the stomach washed out night and morning the day before operation. No food is given on the morning of operation, but a pint of saline fluid, with 1 oz. of liquid peptonoids and 1 oz. of brandy, is given by rectum about half-an-hour before. I usually order a dose of castor oil to be given two nights before, to be followed by an enema the night before the operation is arranged, thus avoiding the necessity of disturbing the patient later. As it is important that the patient should be depressed as little as possible by cold, I have him enveloped in a loose gamgee tissue suit, which can be readily run together by the nurse in an hour or two. The skin of the abdomen and lower thorax is thoroughly washed with soap and water the day before operation, and a 1 in 1000 solution of biniodide of mercury in 70 per cent. alcohol is applied on lint, which is then covered with jaconet or oiled silk and fixed by a bandage, the dressing being changed and re-applied on the morning of operation.

The stomach is exposed by a vertical incision

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made an inch to the right of the mid-line from a point a little below the ensiform cartilage downwards to the level of the umbilicus. The anterior rectus sheath is incised to the same extent, and then the rectus is either retracted externally or the muscle is split, after which the posterior rectus sheath and peritoneum are divided to the same extent. I prefer this incision to the one in the mid-line, as the latter forms a less secure scar, and is inconvenient in case the incision has to be prolonged; moreover, the round ligament, with its irregular adipose envelope, is apt to be in the way.

Should operative measures demand an extension of the incision, it can be prolonged as far as necessary without weakening the abdominal wall, as no muscle is divided in the process. The stomach is now exposed and the whole of the anterior surface can be seen by retracting the margins of the incision and raising the lower border of the liver. If the posterior wall of the stomach has to be examined, the great omentum and the transverse colon should be brought out of the wound, and a vertical incision is then made through the transverse meso-colon, through which the fingers can be passed so as to explore the whole of the posterior gastric wall.

This will end the exploratory abdominal section *qua exploration*, but if needful any further operation can then be proceeded with.

Should nothing further be required, the abdomen

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is closed by a continuous suture of No. 3 iodised catgut, the peritoneum and posterior aponeurosis being first united, the suture returning along the anterior aponeurosis till it reaches the point where the stitching was begun, after which the two ends of catgut are tied and cut short. In order to strengthen the line of sutures two or three interrupted sutures of No. 2 lightly chromicised catgut are passed through and through the aponeurosis and muscle and drawn just tight enough to approximate all the layers, but not so tight as to endanger the tissues being strangulated, after which the edges of the incision are brought together by Michel's metal sutures. Aseptic, dry, double cyanide gauze is then applied, and over this aseptic wool, strapping, and a many-tailed bandage, care being exercised not to compress the lower thorax unnecessarily.

When performed for cancer, the incision need not be larger than to admit two fingers, as it is easy to extend it should that be necessary for more thorough exposure of the stomach. It may be performed under local anæsthesia if thought necessary, but as a rule a general anæsthetic is desirable.

If no disease of the stomach be found, the small incision can be securely closed, and the patient may safely be allowed on the sofa within the week.

If the disease is found too extensive for removal and no further operation be required, it is most desirable that the few remaining weeks of life should not be

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spent in bed, and if the aponeurosis and muscles are united by buried through-and-through silver sutures or by silkworm-gut sutures, and the wound covered with a collodion dressing, the patient may safely be allowed on the couch on the second or third day. The risks of an exploratory operation for diagnostic purposes in an early stage of disease are practically *nil*, and in efficient hands are only likely to occur from some accidental cause, such as pneumonia or pulmonary embolism.

In the later stages, when there is tumour and the disease is too advanced for removal, the risk is, of course, greater, and depends on the condition of the patient rather than on the operation.

Kronlein had a mortality of 9·5 per cent. in seventy-three cases, four from exhaustion, two from pneumonia, and one from pulmonary embolism.

Von Mikulicz had four deaths in forty-four cases —9 per cent., and the duration of life after operation averaged four months.

As these statistics include cases operated on several years back, needless to say they show a much higher rate of mortality than would a corresponding number of cases operated on to-day. Arguing from my own cases the mortality should, I think, not exceed from 2 to 3 per cent. In the St. Mary's Hospital (Rochester, U.S.A.) report for 1905, the brothers Mayo record twenty-five exploratory operations for carcinoma without a death, and in a later

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communication they report having explored the abdomen in seventy-two patients where the disease proved to be beyond removal, with one death. The average stay of these cases in hospital was less than five days.

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CHAPTER IX

GASTRECTOMY

Although so far back as 1810 Merrem, operating on a dog, showed the possibility of a successful removal of the pylorus, the operation was not performed on man until April 9th, 1879, by Pean, the first successful operation being by Billroth, on Febuary 28th, 1881.

It is now universally recognised that a radical operation for the complete and wide removal of the growth should be the aim of surgical treatment for cancer or sarcoma of the stomach.

For gastrectomy to be entirely successful it is desirable that the operation should be undertaken at an early stage of the disease, before extensive adhesions have formed, before the lymphatics have been seriously invaded, and before secondary growths have developed.

The idea that it is too late to perform a radical operation when a perceptible tumour is present is

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exploded, as it is well known that many partial and even complete gastrectomies have led to successful issues in the presence of large tumours; for instance, in one of my cases the tumour on removal weighed a pound, and the operation was only just short of total gastrectomy, yet the patient is in good health over six years later.

It should not be lost sight of that the presence of enlarged lymph-glands does not necessarily imply their cancerous invasion, as ulcers alone or the inflammation of a cancerous tumour may cause glandular enlargement without there being cancerous infiltration of the glands; this I have found on several occasions.

Firm adhesions to neighbouring organs, liver, pancreas, gall-bladder or colon, or to the parietes, as a rule, forbid a radical procedure, though in one of my cases the removal of the gall-bladder, a portion of the liver and the pylorus, as well as a considerable area of parietal peritoneum and the overlying rectus muscle, was not only followed by recovery, but the patient is well over six years later, the disease having been proved to be cancer, not only by the clinical record, but by its feel and appearance and by microscopic investigation.

If the tumour, though somewhat tied up by adhesions, is movable, even if adherent to the colon, it need not necessarily be given up as hopeless, as under such circumstances a number of successful

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partial gastrectomies, including partial colectomy, have been performed. I have also successfully removed a part of the pancreas which was adherent to, and apparently infiltrated by, a growth of the pylorus.

No good purpose will be served by a gastrectomy that does not remove the whole of the disease, as recurrence will be certain to occur, and probably as much relief with a very much diminished risk would be given by a smaller operation.

Partial gastrectomy of the pyloric end of the stomach.—I have not used the term "pylorectomy," as the simple removal of the pylorus is only justifiable in non-malignant disease, such as chronic ulcer. Whenever the disease is thought to be malignant a more extensive operation must be done, involving a partial excision of the stomach itself, including the pylorus if that be diseased.

If the exploratory operation previously described has shown the tumour to be a removable one, involving the pyloric end of the stomach, the incision is extended up to the notch between the ensiform cartilage and the right costal margin and down to the level of the umbilicus or beyond it.

It will now afford some help if a small sandbag be placed under the back opposite the lower ribs, as in that way the area of operation is brought close to the surface; or better still, a mechanically-operated table will accomplish the same purpose

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in a moment; the one I employ is known as the Guyot-Greville table.

The lesser omentum is divided between two rows of interrupted catgut sutures applied by means of a curved blunt needle in handle, the ligament being divided at a distance from the lesser curvature of the stomach so as to include the glands in the part to be removed.

In order to save hæmorrhage, there is an advantage, quite early in the operation, in ligaturing in their continuity, or catching in pressure forceps the four arteries with their accompanying veins supplying the pyloric end of the stomach; these are the gastric, best divided at a point about $\frac{3}{4}$ to 1 in. below the cardiac orifice where it joins the lesser curvature; the pyloric, just above the pylorus, shortly after it leaves the hepatic artery; the right gastro-epiploic or gastro-duodenal, as it passes down behind the pylorus; and the left gastro-epiploic, just below the greater curvature of the stomach at the point where the section of the stomach is to be made. An aneurysm needle carrying a double catgut suture is the method I prefer, and the artery and vein are taken up together and divided between the double ligatures.

It saves time and answers equally well to seize the four vascular trunks in pressure forceps, and when the excision of the stomach is done to ligature them singly.

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The fingers of the left hand are then passed into the lesser peritoneal sac and made to encircle the growth and to cause the great omentum to project forward, thus avoiding the transverse colic vessels, the ligature of which would endanger the vitality of the transverse colon. The great omentum is then ligatured off and divided in the same way as the lesser, as wide a margin of omentum as possible being left attached to the part of the stomach to be removed.

Double clamps are then applied to the duodenum and also to the stomach on the cardiac side of the growth, and between the clamps the duodenum is divided quite half an inch on the distal side of the growth and the stomach an inch or more beyond the proximal side of it. The growth, which is then free, is lifted away, the clamps occluding the cut ends and preventing any of the contents soiling the wound.

A careful search must now be made for any glands that may have been missed and any such should be removed. Any bleeding vessels are ligatured and the wound is cleansed by dry aseptic swabs.

The junction of the stomach and duodenum may be carried out in one of several ways:

(1) By immediate suture of the open end of the duodenum to the open end of the stomach (Billroth) (terminal union).

(2) By closure of the stomach opening and implantation of the open end of the duodenum into

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the posterior surface of the stomach (Kocher) (termino-lateral union).

(3) By closure of both the stomach and duodenal openings and the independent formation of a gastro-jejunostomy (Billroth) (lateral union).

(1) *By immediate suture of the cut ends.*—This

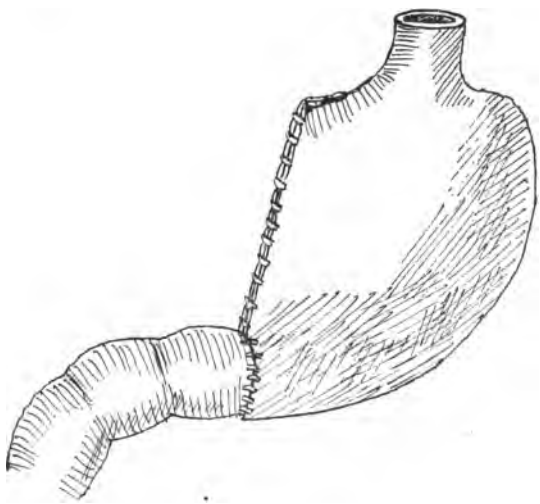

FIG. 6.—Partial gastrectomy; end-to-end junction.

method was advocated by Mikulicz and Kronlein. Although statistics seem to prove that it is attended with greater risks than the other methods on account of the fear of leakage at the critical angle between the vertical and circular sutures, I feel sure these difficulties and dangers can be overcome by the use of a continuous suture over a decalcified bone bobbin.

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I have carried out the operation in a number of cases that have progressed most satisfactorily. The inequality in the size of the stomach opening is overcome by a partial closure of the stomach incision so as to leave the gastric opening of a size equal to that in the duodenum. The two openings may then be

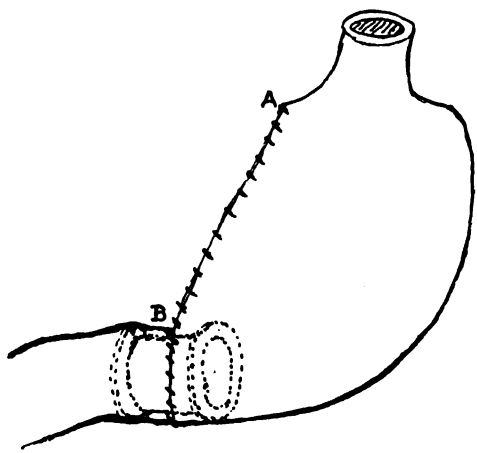

FIG. 7.—Partial gastrectomy; end-to-end junction by means of the decalcified bone bobbin as a splint over which to apply the sutures.

joined either by means of sutures or by sutures around a decalcified bone bobbin, which forms a splint and ensures the opening being made of sufficient size. The bobbin is of the greatest possible advantage in this situation, as a large proportion of deaths that have occurred from simple suture have been due to a leakage at what has been termed "the

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fatal suture angle of Billroth"—a danger which can be wholly avoided by its use.

Mr. Rutherford Morrison advocates the junction by simple suture, and in order to make the opening in the duodenum correspond in size with that in the stomach he makes a slit half an inch in length down the centre of the anterior wall of the duodenum. By spreading out this longitudinal cut the duodenal opening is so widened that it may be made to correspond in size with the stomach opening.

The method of joining the cut ends by suture is the same whether the decalcified bone bobbin is employed or not; the only difference is that at a certain stage the bobbin is introduced before the sutures are continued around the anterior half of the circle.

The method is as follows: While the clamps are still in position a long chromic catgut suture is passed through all the coats of the cut stomach wall, beginning at the upper end. This is carried down until a point is reached (B) which will leave the stomach opening of a size to correspond with that of the duodenum. At this stage the suture is passed beneath the last loop so as to prevent it slipping, and the needle is then temporarily laid aside, still threaded. The sutured edges are now inverted, and a serous suture, which only transfixes the serous and muscular coat, is then inserted, commencing at the point A and drawing together the serous surface as far as the place where the marginal suture was laid

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aside. The open ends of the two viscera are then placed in apposition and the serous suture is continued around the posterior half circle, uniting the peritoneal coats of the duodenum and stomach about a quarter of an inch from the margins of the opening that is to be permanent between the stomach and bowel. The needle is then laid aside, still threaded, and the marginal catgut suture previously laid aside is now taken up and continued around the posterior part of the opening through all the coats of the two viscera, so as to make the mucous membranes continuous, and at the same time to act as a hæmostatic suture. After this has been carried around the posterior half circle, if the bobbin is employed it is now placed in position; but whether the bobbin is inserted or not, the mucous suture is continued round, taking up all the coats on the anterior part of the the circle until it reaches the point B, where it is secured by a knot and cut short. The serous suture is now taken up and continued round to the same place, taking up the serous coats of the duodenum and stomach, when it is also knotted off and cut short. At the angle between the vertical and circular part of the suture there should be no point of danger, and no tension if the stitching has been well done, but if there is any doubt it may be advisable to insert two or three separate serous sutures of Pagenstecher's thread in order to strengthen this point, which has been termed the angle of danger.

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(2) *Kocher's method.* — Professor Kocher, whose method has been carried out most successfully, not only by himself, but also by many other surgeons, closes the cut end of the stomach by means of a continuous catgut marginal suture, taking up the whole thickness of the cut surfaces, including the mucous

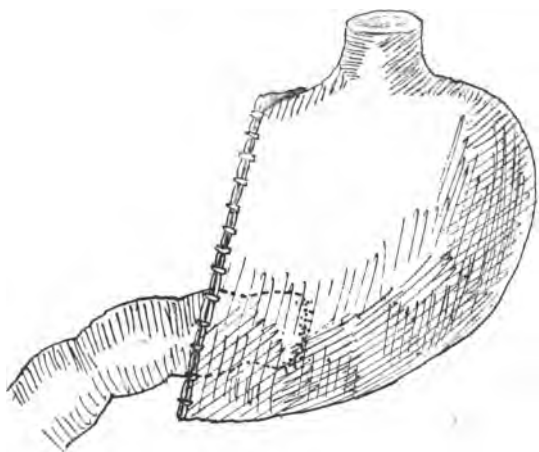

FIG. 8.—Partial gastrectomy; Kocher's method, end-to-side junction.

membrane, after which the united edges are invaginated and closed in by a silk or Pagenstecher's thread for the serous surfaces. The open end of the duodenum is then applied to a new opening made in the posterior surface of the stomach, to which it is united. This part of the operation may be accomplished either by simple continuous sutures or by

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sutures around a decalcified bone bobbin. The junction by suture or by suture around a decalcified bone bobbin differs in no way from the method described under gastro-enterostomy, except that in this case the open end of the duodenum is applied to an incision in the back of the stomach, whereas in as ordinary gastro-enterostomy the openings are both into the sides of the viscera to be joined.

In some cases it may be found easier to make the anastomosis through the front of the portion of stomach remaining instead of through the posterior wall, and in the cases on which I have made the junction by applying the open end of the duodenum to the anterior gastric wall the results have been equally good.

(3) *The third method.*—In it the open end of the duodenum and the open end of the stomach are closed by sutures, and a loop of jejunum is united to the lower end of the cavity in the stomach. It may be performed either by the anterior or posterior method, and in no way differs from the ordinary operation of gastro-jejunostomy. This operation may be performed with advantage in two stages where the patient is not in a very good condition and unable to bear the complete procedure. In such cases the gastro-jejunostomy is first performed, the bowel being united to the lower border of the cardiac end of the stomach. From two to four weeks later, when the patient has gained more strength, the second or

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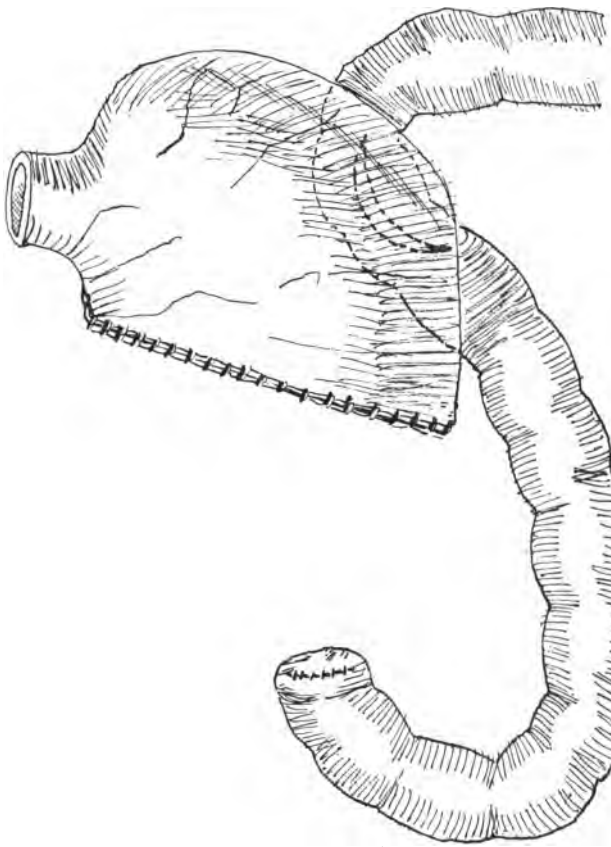

FIG. 9.—Partial gastrectomy; closure of both cut ends and side-to-side junction of the viscera.

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radical operation is performed, the disease being completely and widely excised, and both cut ends being closed by sutures.

The following case serves as an illustration of the method performed in two stages, a procedure only to be recommended when the patient is too feeble to bear the complete operation. The patient, a man aged sixty-three years, had suffered from stomach symptoms for a year, a tumour having been noticed for a month. Gastro-enterostomy was performed on November 15th, 1900. A central ring of cancer was found dividing the stomach into two cavities. The patient was too ill to bear gastrectomy. A good recovery was made, with a rapid gain in weight and strength, so that on December 20th the complete removal of the growth by gastrectomy was well borne. The patient lived for sixteen months and enjoyed life. He took his food well up to within a short time of the end.

Much has been written as to which is the best method of uniting the small intestine to the remains of the stomach in partial gastrectomy. My own feeling is that each case must be a law unto itself, for I have tried all the three methods—end-to-end, end-to-side, and side-to-side—and I believe that each can be done with equally good results in suitable cases. I feel sure that the end-to-end method can be more safely accomplished by suture over the decalcified bone bobbin than by suture alone, but I think that

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as a rule the end-to-side method known as Kocher's operation will be found the most generally useful, and in Professor Kocher's hands, as well as in the hands of other surgeons, the union of the divided end of the duodenum to a new opening in the posterior or anterior wall of the stomach, when a sufficient amount of duodenum is available, will be found to be the best of all procedures.

In making this statement it has, however, to be borne in mind that in case of recurrence the places of section of the viscera will be the most likely sites of return growth, which would in that case lead to stenosis, whereas if the side-to-side method were adopted the recurrence of disease would be less likely to interfere with the passage of food onwards.

Moreover, the side-to-side method is available even if a considerable portion of the duodenum should have to be removed, and it is the method to recommend when a patient is very feeble and it is doubtful if he will bear the complete operation at one sitting.

Partial gastrectomy of the body of the stomach as in hour-glass deformity.—This operation is practically the same as the partial gastrectomy of the pyloric end of the stomach, except that the clamps are placed on each side of the growth, and the section of the stomach is made at a distance of not less than 1 in. away from the tumour on each side. Neither the pyloric nor cardiac orifices are interfered with, and the junction is made by a con-

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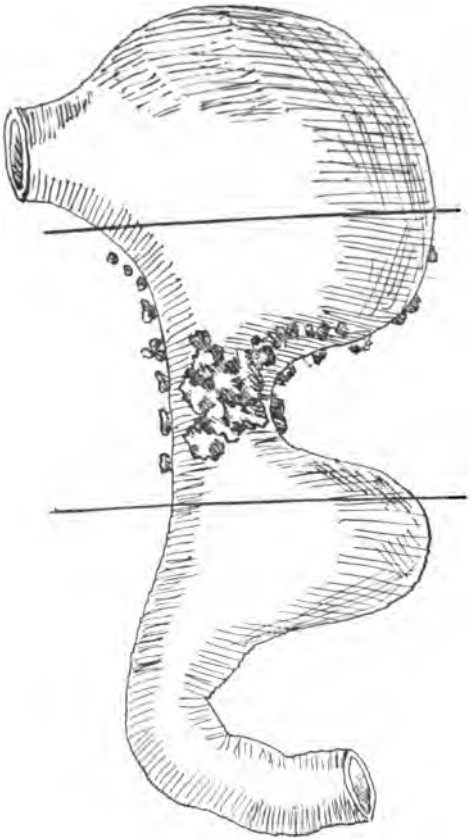

FIG. 10.—Gastrectomy for malignant hour-glass constriction.

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tinuous serous suture of Pagenstecher's thread surrounding a continuous catgut suture embracing all the coats, and bringing together the mucous surfaces.

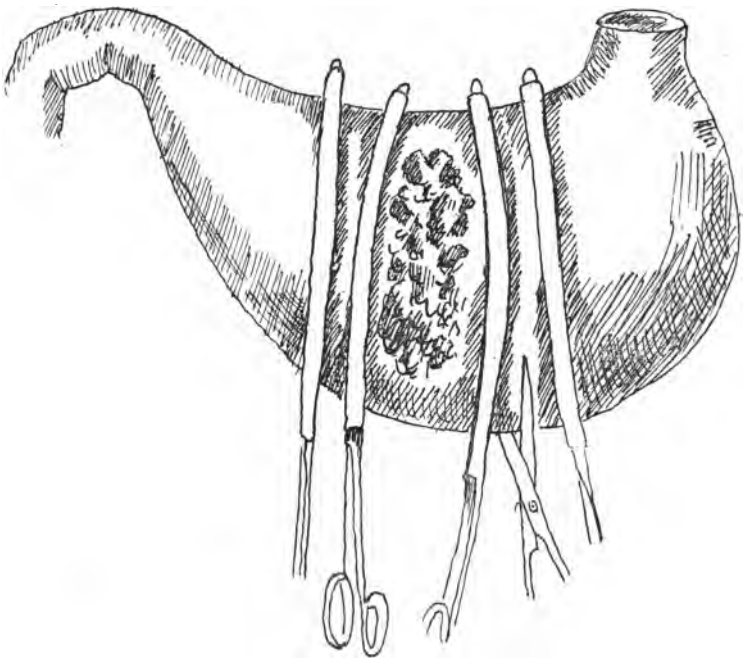

FIG. 11.—Gastrectomy for hour-glass constriction due to cancer.

The vessels along the lesser and greater curvatures are caught in pressure forceps or are divided between two ligatures before applying the clamps.

Complete gastrectomy.—This formidable operation was first conceived and performed by Connor of Cincinnati in 1883. Unfortunately the patient died

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on the table, and it was not until fourteen years later that the first successful complete gastrectomy was performed by Schlatter, of Zurich, on September 6th, 1897, and the second by C. B. Brigham, of Boston, on February 24th, 1898. In Schlatter's operation the cut end of the œsophagus was united to a loop of jejunum, the duodenal opening being closed. In Brigham's operation the cut ends of the œsophagus and duodenum were united over a Murphy button.

Up to October, 1905, twenty-seven of these operations had been performed by various operators, and it is interesting to note that Mr. H. J. Paterson was able to obtain information that ten of the patients were living and well 8 years, 7 years, 5 years, $4\frac{3}{4}$ years, 4 years, $3\frac{1}{2}$ years, 2 years, $1\frac{3}{4}$ years, and two others at lesser periods after operation; while others survived $3\frac{3}{4}$ years, $1\frac{3}{4}$ years, 13 months, 9 months, and 7 months respectively, death from operation having occurred in 10 cases—a remarkable series when the severity and extent of the operations are taken into consideration. The operation is merely an extension of that already described under partial gastrectomy, the clamp seizing the œsophagus just above the stomach instead of the stomach itself. If the stomach be pulled gently downwards the orifice may be made to protrude through the aperture in the diaphragm for a little distance so as to leave room for the application of a clamp to the lower end of the œsophagus.

Although, if a small portion of the dome of the

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stomach be left (sub-total gastrectomy), as was the case in one of my patients who is still living and well over six years later, the operation cannot then be called a complete gastrectomy, yet I have no hesitation in advising this modification in suitable cases, as it enables the junction between the intestine and œsophagus to be made so much more easily. If, however, the operation of total gastrectomy is performed, the open end of the œsophagus can be joined to the intestine by means of sutures, as in Schlatter's case; by the Murphy button, as in Brigham's case; or by means of the decalcified bone bobbin, as in the case to which I have referred, all of these patients having recovered.

Should it be found that an anastomosis between the œsophagus and the intestine cannot be effected, the opening into the œsophagus may be tightly clamped and ligatured in the groove made by the clamp, the mucous membrane beyond the ligature being taken away. The open end of the duodenum may then be closed and a jejunostomy performed by the method I have described on p. 152. This would be simpler and probably safer than performing a duodenostomy as has been done in one recorded case.

The passage of a rubber œsophageal tube from the mouth to the stomach affords a help while the sutures are being applied, and somewhat simplifies the operation, but if a decalcified bone bobbin is

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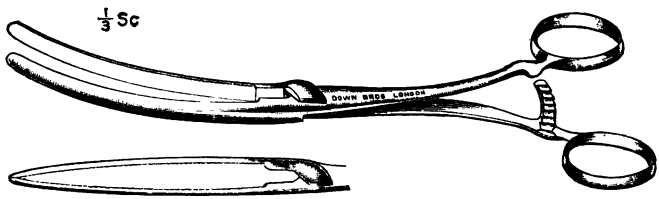
being used the aid of an œsophageal bougie is not called for.

In some of the published articles on gastrectomy arbitrary lines of incision of the stomach-wall have been given; it seems to me that this is undesirable; the extent of the disease should be the chief guide and in no case should the cardiac end of the stomach be divided nearer to the growth than from 1 to 2 in.

As the chief course of the lymphatics is along the

FIG. 12.



lesser curvature as far as the point where the gastric artery joins it, in any case of cancer of the pyloric end of the stomach the incision through the lesser curvature ought not to be nearer the pylorus than 1 in. from the cardiac orifice. With due precaution little or no blood is lost, and all soiling of the abdomen by stomach contents is avoided; drainage is, therefore, usually unnecessary and undesirable.

The clamps I use I have employed for many years for all kinds of stomach and intestinal surgery; they are thin in the blade so as not to exert

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unnecessary pressure, and I usually have them sheathed with indiarubber tubing so that no damage to the visceral walls occurs. They are made for me by Messrs. Down Bros., and are shown in the diagram.

The curved intestinal needles I use for all visceral suturing I have also employed since 1884, and with slight modification in size and thickness they have done me very good service. I never use a needle-holder.

The results of gastrectomy immediate and remote.—No useful purpose can be served by comparing the results of gastrectomy with those of gastro-enterostomy for cancer, since the latter operation in malignant disease is reserved for late cases that have passed the stage when gastrectomy would have been a justifiable operation; nor do I consider that an estimate of the true value of gastrectomy can be attained by a consideration of the earlier cases operated on before the technique had been perfected.

Up to the end of 1905 Kocher had performed 110 partial resections of the stomach with a mortality of 24 per cent., but of the cases, fifty-eight in number, operated on since 1898, the mortality was only 15 per cent., a percentage closely corresponding to that of the brothers Mayo, who up to the end of last year had performed 100 gastrectomies with a mortality of 14 per cent.

In my own practice since 1896, the mortality for

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partial gastrectomy has been 14 per cent., and Maydl's statistics give a 16 per cent. mortality.

We may thus conclude that the immediate risks of partial gastrectomy, as calculated from a considerable series of cases, are between 14 and 16 per cent.

Of the twenty-seven cases of total gastrectomy collected from all sources by Mr. H. J. Paterson (1), ten died, a mortality of 36 per cent.

Of the twenty cases of sub-total gastrectomy, six died, a mortality of 30 per cent.

The remote results are equally interesting and not less important, not only from the point of freedom from recurrence, but also as to the effect on the general health and comfort of the patient after the removal of the whole or part of the stomach. I have had under my notice for over six years a case of sub-total gastrectomy, and from observations on this case it would seem as if the whole of the functions of the stomach could be replaced.

It would at first sight appear that as a reservoir the stomach could not be replaced, but the fact that a meal of moderate size can be taken shows that the upper end of the duodenum, or the lower end of the œsophagus, or both, become dilated and serve that purpose, though, perhaps, to a limited extent. The mechanical functions of the stomach can be vicariously performed by the mouth and by a careful selection of diet. The digestive functions of the stomach can be taken up by the pancreatic and the intestinal secre-

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tions, and the absorption which normally occurs in the stomach can as easily take place in the intestine.

Pachon and Carvalho (2) have shown that dogs may gain in weight and remain in perfect health after removal of the entire stomach, and further observations on patients after complete gastrectomy, as in Schlatter's case, show that perfect health is compatible with absence of the stomach.

Of the twenty-seven total gastrectomies (1), it is interesting to note that ten are living and well 8, 7, 5, 4¾, 4, 3½, 2, and 1¾ years, and two others at less periods after operation, while others survived 3¾ years, 1¾ years, 13 months, 9 months, and 7 months respectively.

With regard to the sub-total gastrectomies, of the fourteen patients who recovered from operation one was well 7½ years, one 6¾ years, and one 5¼ years after operation, while of the others, one survived operation for 11 years and died of heart trouble without recurrence, one 5 years, two 2¾ years, two 1¾ years, and one 1½ years respectively.

The immediate results of partial gastrectomy have been mentioned above, and the final history has been obtained by Mr. H. J. Paterson in fifty-five of those that recovered. Of the fifty-five patients, thirty-five have died since the operation, one died from recurrence 7 years and two 5 years later; but it is interesting to note that all the other patients in whom recurrence ensued died within 3½ years, so that if a patient

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remains free from recurrence for four or more years there would seem to be a strong probability of cure. Eight of the patients who died, lived over 3 years after operation, and the average duration of life in cases where recurrence took place was just over 2 years. Of the patients who are apparently cured, one is alive and well 14 years, one 7½ years, two 6 years, one 5 years, two 4 years, five over 3 years, and three over 2 years subsequent to operation, and one was living 4½ years after operation, but recurrence was feared. Thus nearly 14 per cent. of the patients who recovered from operation would seem to be cured or to have a reasonable prospect of remaining free from recurrence.

After a careful analysis of all the cases operated on I cannot help feeling that far too gloomy a view is taken of cancer of the stomach, for if the disease be caught early and a wide excision peformed, care being taken to remove the lymphatic area of the stomach with the glands along the lesser curvature, results even better than those I have just mentioned will be obtained. Our great hope of success, I venture to state at the risk of being accused of reiteration, lies in early and complete removal.

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CHAPTER X

INDICATIONS FOR THE PERFORMANCE OF GASTRO-ENTEROSTOMY IN MALIGNANT DISEASE OF THE STOMACH

(*a*) In dilatation of the stomach due to stenosis of the pylorus from cancer, where the disease is too diffused or the glands are too much involved for successful gastrectomy.

(*b*) The operation of gastro-jejunostomy is not to be recommended in cases of cancer or sarcoma of the stomach where the disease is limited in extent and capable of radical removal by gastrectomy.

(*c*) In case of cancer invading the pylorus or pyloric end of the stomach or the duodenum incapable of radical removal, even though obstruction of the lumen be at the time incomplete, a gastro-jejunostomy should be performed in order to prevent obstruction.

(*d*) Under similar conditions the short-circuiting operation may cause a great diminution in the size of the growth and in its activity, by putting it at rest.

(*e*) In hour-glass stomach due to cancer, where the growth is tending to produce a constriction in

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some part of the stomach and so leading to obstruction, a short-circuiting operation, whereby the proximal gastric cavity is connected to the jejunum, is capable of affording great relief and of retarding the growth of the tumour.

(*f*) In doubtful tumours at the pylorus, which are adherent to the liver, pancreas, and adjoining parts, and where the glands are involved, the performance of a gastro-jejunostomy may prove entirely curative, as chronic ulcer with thickening may simulate cancer, and in that case will be cured by the rest secured by the operation.

(*g*) In hæmorrhage from cancer or sarcoma of the stomach and when the growth cannot be removed, a gastro-enterostomy may give great relief, and secure arrest of the bleeding.

(*h*) In persistent vomiting, either from retention or from irritation, a gastro-jejunostomy may, if the disease is not too far advanced, give great relief.

(*i*) In dilatation of the stomach dependent on pressure on the pylorus or duodenum from tumour of the pancreas, liver, or gall-bladder incapable of removal, a short-circuiting operation may be the means of giving great, though perhaps only temporary, relief.

(*j*) In certain cases where a cancer of the pyloric end of the stomach is removable and the glands are not too involved for a radical operation to be undertaken, but in which the patient is too feeble to bear the major operation, a gastro-jejunostomy may be

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performed, and after the patient has improved in the course of two or three weeks the gastrectomy may be carried out with great expedition, as the anastomosis has already been done and will save a considerable amount of time.

It is not necessary to mention the many indications for operation when the disease is simple, but I would remark that in all cases of chronic ulcer, whether producing obstruction or not, a gastro-jejunostomy should be done as a curative operation for the ulcer and a preventative of cancer, to which chronic ulcer strongly predisposes.

The operation of gastro-enterostomy.—The operation of gastro-enterostomy was first performed by Wölfler at the suggestion of Nicoladini on September 28th, 1881. The patient, who was suffering from cancer of the pylorus, lived for four months.

For some years later so little confidence was placed in this and other operations on the stomach, that cases were, as a rule, treated medically until almost moribund before surgical treatment was considered advisable, with the result that the mortality was appalling. For instance, between 1881 and 1885 the mortality of gastro-enterostomy was 65·7 per cent. There is, however, a very different statement to make to-day, when one can point to a personal experience of a series of nearly 300 posterior gastro-jejunostomies, undertaken for both simple and malignant disease, with a mortality of only 3·4 per cent, and to a series

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of nearly 200 cases in which the operation was performed in my private practice for ulcer and its complications, with a mortality of only 1·5 per cent.

These and similar results by other surgeons bring the procedure well within the realm of safety, and seeing that it has to be undertaken in many cases for diseases that would be otherwise inevitably fatal, it may be looked on as an operation the benefits of which not even the most conservative practitioner can afford to ignore. These changes have been brought about, not only by patients being operated on at an earlier stage and under more favourable conditions—for many of my patients have been extremely ill at the time of operation—but also by greater care in technical details, by greater expedition in operating, by more careful asepsis, by the avoidance of, or greater care in, the use of irritating antiseptics, by the prevention or better treatment of shock, by care in post-operative treatment, such as early feeding subsequently to operation, and by the careful preparation of the patient.

The preparation of the patient.—It has been the custom with many surgeons to put patients suffering from disease of the stomach through a long course of preliminary treatment, such as frequent lavage of the stomach and abstention from food before operation. This, as a rule, is quite unnecessary, and certainly inadvisable in the greater number of cases; first, because the treatment is depressing and debilitating

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in the case of patients already exhausted by a long illness; secondly, as proved by Dr. Harvey Cushing's bacteriological investigations, the stomach contents speedily become aseptic if the mouth be cleansed and aseptic foods administered; and thirdly, as proved by ample clinical experience, elaborate preliminary treatment is unnecessary to success.

If the stomach is greatly dilated and the contents are foul, then lavage with simple boiled water night and morning is adopted on the day before operation. The careful cleansing of the mouth and teeth and the administration of foods sterilised by boiling are advisable. The last light meal is given the night before, about twelve hours, and a nutrient enema is given about one hour before operation. In ordinary cases no lavage is adopted, but care is exercised in cleansing the mouth and giving sterilised food for thirty-six or forty-eight hours prior to operation, and a nutrient enema consisting of 1 oz. of brandy, 1 oz. of liquid peptonoids, and 10 oz. of normal saline solution is administered about an hour before operation.

Every patient is enveloped in a suit of cotton wool made by the nurse out of gamgee tissue, and each has an injection of from 5 to 10 ♏ of liquor strychniæ (B.P.) administered subcutaneously before or during the operation. The preparation of the skin and other aseptic details of the operation differ in no respect from those observed in operations generally.

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Although the operation of gastro-enterostomy has been performed in many different ways there are practically only two distinct methods: one Wölfler's, in which the jejunum is fixed to the anterior stomach-wall, and the other von Hacker's, in which the anastomosis is effected between the jejunum and the posterior wall of the stomach. From a somewhat extensive experience of the two, I have no hesitation in strongly recommending the posterior, where that operation is possible, for it must be granted that there are some exceptional cases in which, on account of adhesions to the pancreas, extensive involvement of the posterior wall of the stomach by growth or from congenital deformity, "a very short meso-colon," the anterior method may have to be selected or a Roux's operation performed.

The following is a description of the operation which I am in the habit of performing:

The abdomen is opened by an incision 3 to 4 in. long, 1 in. to the right of the middle line above the umbilicus. The stomach is thus exposed. Sterilised gauze is laid on the abdomen surrounding the wound. The great omentum and the transverse colon are then lifted up and brought out of the wound, thus exposing the under surface of the transverse meso-colon and the attached part of the jejunum on the left side of the second lumbar vertebra. The bowel is caught up in a clamp just beyond the duodeno-jejunal flexure, at which place the anastomosis is made, thus avoiding

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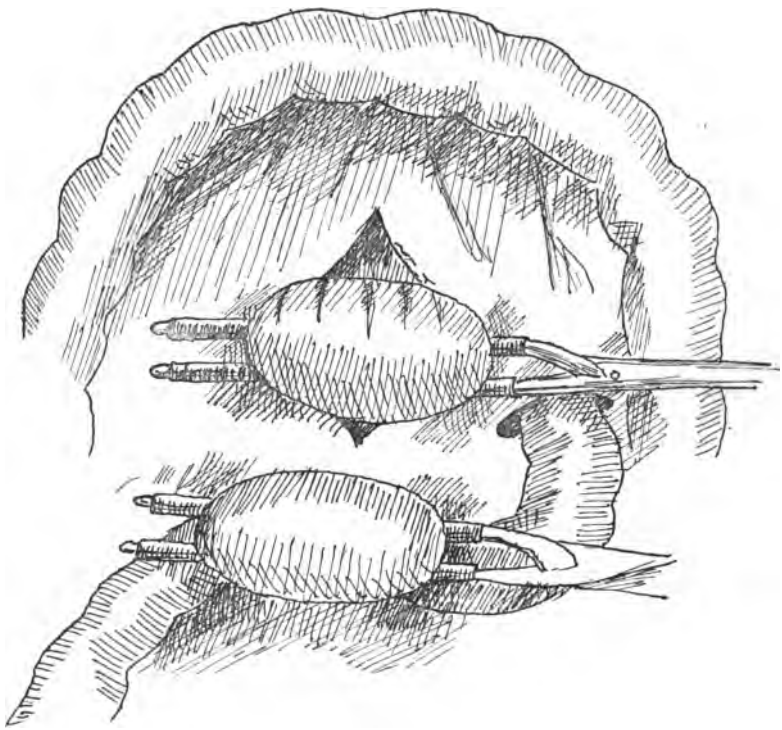
any loop. A vertical slit is then made in the transverse meso-colon between the blood-vessels, which are readily seen. By pressing with the left hand above

FIG. 13.



the colon the posterior wall of the stomach is made to project through the opening in the meso-colon, the lower border of the stomach being readily recognised by the blood-vessels which are coursing along

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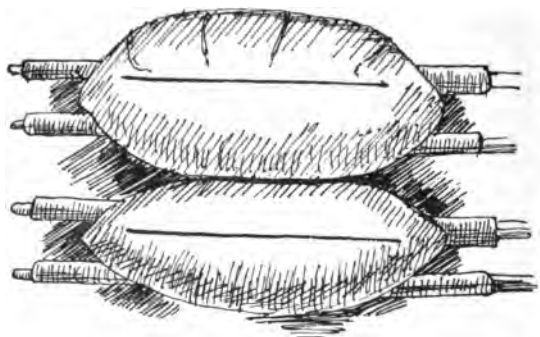
it. The most dependent part of the stomach close to the lower border is then brought through the slit and grasped by a clamp as shown in the diagram.

The great omentum and the transverse colon are then returned into the abdomen above the parts to be anastomosed, and covered with a sterilised gauze pad. The two clamped portions of the bowel and stomach are now placed side by side with a strip of

FIG. 14.



gauze behind and between them. Two or three vessels passing from the main gastro-epiploic arteries across the part where the stomach has to be incised are ligatured in their continuity so as to save bleeding when the stomach is cut. A continuous suture of No. 1 Pagenstecher thread in a round, fully-curved needle is employed to unite the serous surfaces for a distance of from 2 to 2½ in., the needle being then laid aside threaded. A quarter of an inch in front of this serous suture the two viscera

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are incised, and the edges are united by a chromic catgut suture, which takes up all the coats and brings into apposition the mucous membrane of the intestine and stomach. This suture is continued round the circle until it reaches the point where it began, when the suture is at once tied off and cut short. The serous suture previously laid aside is now taken up and continued round the front half of the circle in front of the newly-made opening until the point is reached where it began, when the two ends are knotted and cut short. The edges of the aperture are thus united firmly by a serous and a marginal suture. The clamps are now removed and the piece of gauze behind the anastomosed viscera is then drawn out and the omentum and stomach are brought down to their normal position. In order that there may be no kinking at the point of junction I am accustomed to place one or two additional sutures on the distal side of the united viscera and to bring the distal part of the jejunum over to the right side of the spine in arranging the visceral toilet. Two or three interrupted sutures are used to unite the margin of the meso-colic opening to the stomach and jejunum. The omentum and transverse colon are then brought down into their normal position, and the abdomen is closed by a continuous No. 3 catgut suture, which first unites the peritoneum and the posterior rectus sheath together, and the same suture returning unites the anterior sheath of

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the rectus; but in order to give additional strength to the abdominal wall I usually pass from three to six through-and-through No. 2 slightly chromicised catgut sutures, which, however, do not penetrate the

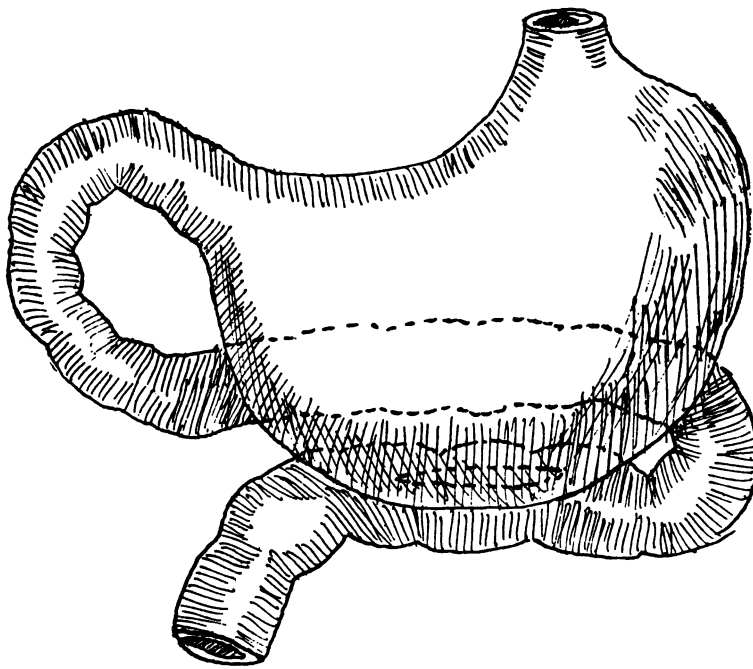

FIG. 15.—Gastro-jejunostomy showing the relation of the jejunum to the stomach after the anastomosis has been effected.

skin, and which are cut short and buried beneath it. The van Horn 20-day chromic sutures are here very useful. The skin is then brought together either by means of several interrupted silkworm-gut

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sutures or by the well-known Michel's metal clips, which I myself prefer.

It will be noticed that I have said nothing of making the opening in the stomach oblique, nor of excising redundant mucous membrane, nor of displacing the large vessels coursing along the greater curvature, for these modifications of the operation are quite unnecessary.

The anastomotic opening should be made close to the lower border of the stomach, and the opening should never be less than 2 in. in length. If, as should be the case, the mucous margins of the stomach and bowel are united, there is no fear of serious subsequent diminution of the opening by cicatricial contraction.

The modification I used to adopt of inserting a decalcified bone bobbin before completing the anterior half circle of the continuous sutures secures an immediately patent opening and removes the possibility of kinking. Those who have had the opportunity of observing my cases after the employment of the bone bobbin and cases in which the simple suture has been used without any splint, have expressed to me their belief that the recovery is smoother than when the bobbin is not used; but as a matter of fact I have employed simple sutures for a considerable time, and have found the results equally satisfactory.

The use of the Murphy button is on quite a different principle, as it acts by causing pressure

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necrosis of the apposed surfaces. It can certainly be done a little quicker, though really very little time is saved; but the two fatal objections to its use are the small size of the opening, which tends to contract, and the danger of the button falling back into and being retained in the stomach, a danger which is proved to have frequently occurred in practice, necessitating in many cases a further operation. I therefore personally never employ it, and cannot recommend its use to others.

A modification of the posterior operation has been suggested by Dr. W. J. Mayo (1) which has given him satisfactory results. The operation which is shown in the diagrams consists in attaching the jejunum to the stomach in its vertical direction, the advantage claimed being that it does not alter the axis of the jejunum.

The suggestion of McGraw to make the incision safer by the employment of an elastic ligature is to my mind neither necessary from the point of view of safety nor desirable from that of accuracy; moreover, as the anastomosis has to be made by a process of sloughing which takes some days to complete, and always leads to an opening of uncertain size and one with a tendency to contract, I have the feeling that the method, though ingenious, is clumsy and inexact, and one which should not be employed by a surgeon who is capable of adopting the more exact technique herein described.

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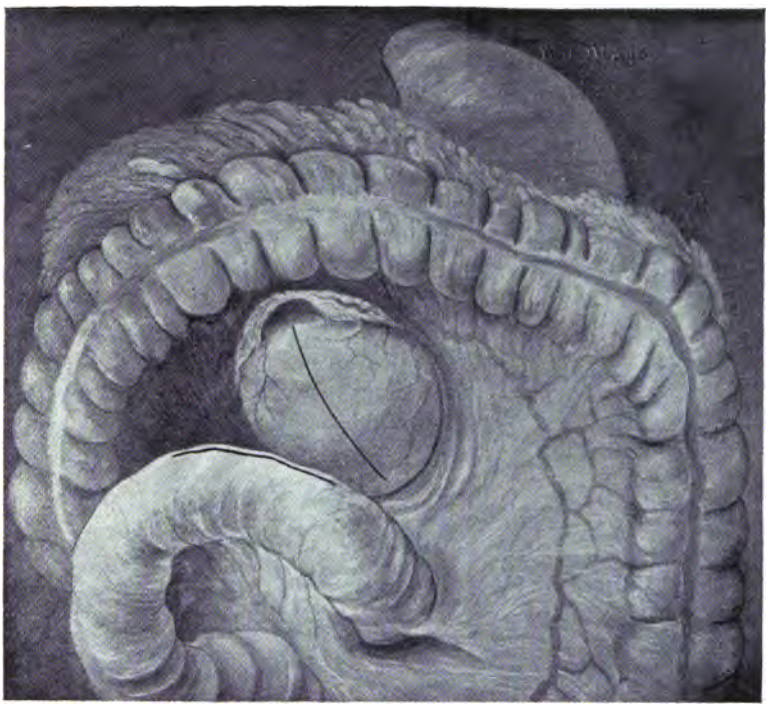
PLATE XI.



Completed operation from behind margin of torn mesocolon attached by several interrupted sutures to line of union.

(W. J. Mayo.)

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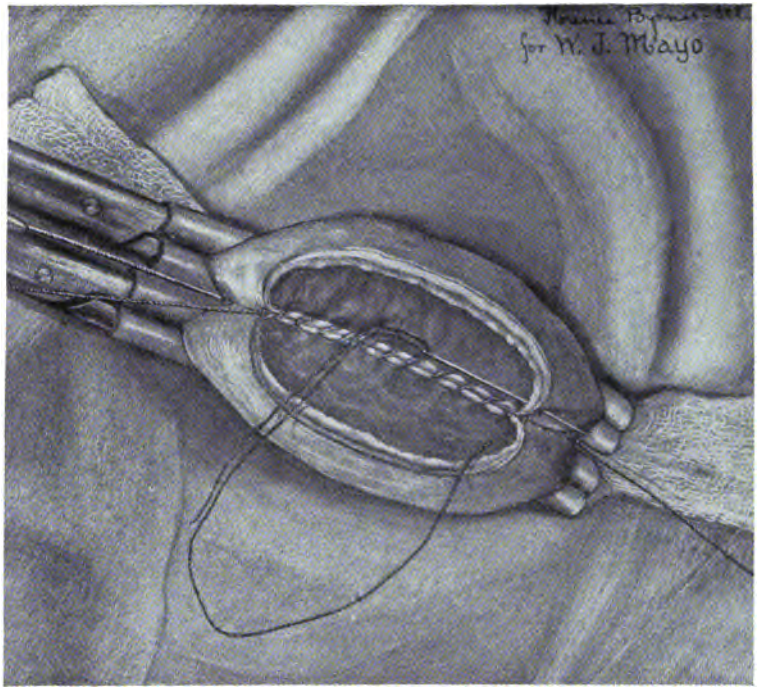
PLATE XII.



Forceps in place and anastomosis half completed by suture.
(*W. J. Mayo.*)

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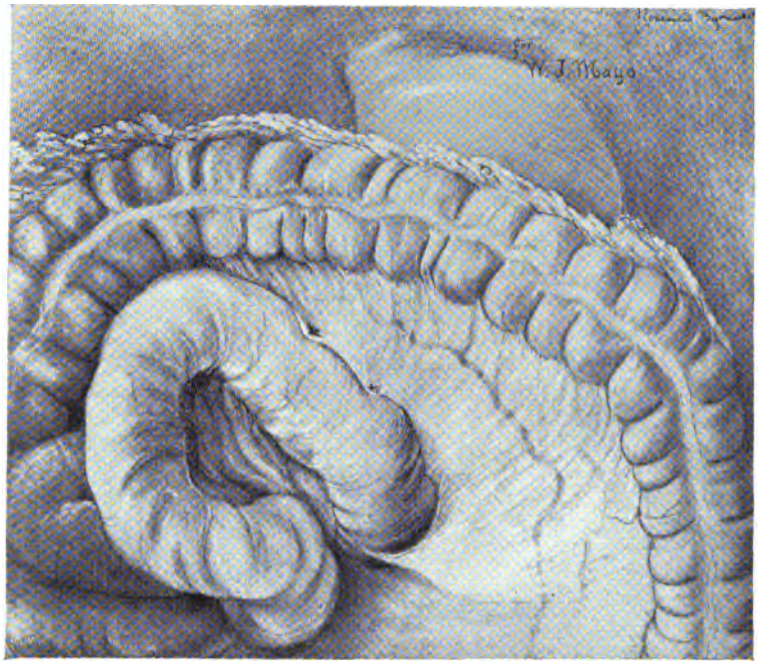
PLATE XIII.



Completed operation from behind margin of torn mesocolon attached by several interrupted sutures to line of union.

(W. J. Mayo.)

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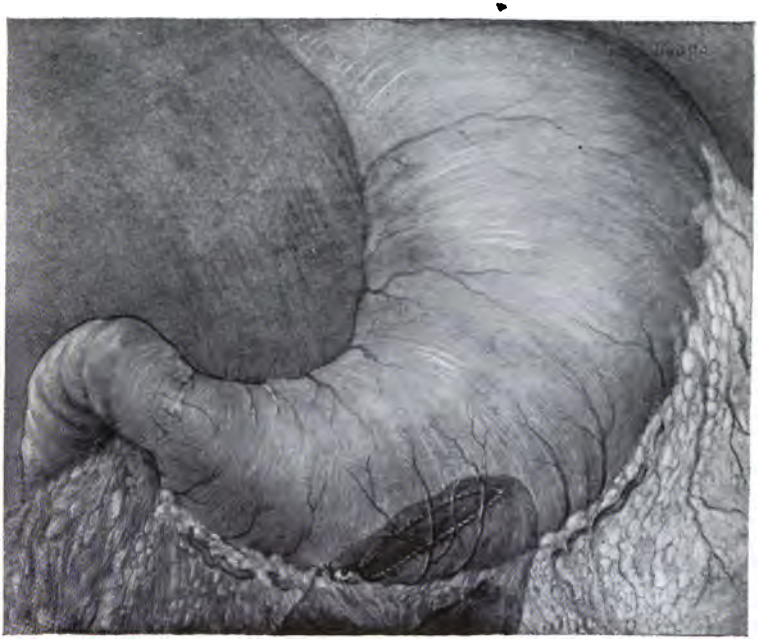
PLATE XIV.



Completed operation from in front. Anastomotic opening shows through as darkened area on posterior wall. Note that it goes to the bottom of the gastric cavity and slightly anterior, as indicated by suture line in the omental attachment.

(W. J. Mayo.)

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When an operation involving so many possibilities of danger, and often undertaken in very serious conditions, can be accomplished with a little over 1 per cent. mortality in over 100 consecutive cases of ulcer and other simple disease of the stomach, there cannot be much seriously wrong with the technique, and when I see alternative methods suggested, such as Roux's Y operation, or that of short-circuiting the jejunal loop, both of which involve the making of a double anastomosis, and which are acknowledged to be done in order to avoid the complication of the vicious circle—a complication which does not occur when the operation I have described in detail is performed—I am at a loss to understand why such operations continue to be done save under very exceptional circumstances.

Although I have given a description of gastro-enterostomy as I have done it for several years, and one which I know has stood the test of numbers and of time, I feel that for a text-book the description of the operation would not be complete were I not to describe other methods.

Anterior gastro-enterostomy.—Anterior gastro-enterostomy is performed like the posterior, except that in this case the anastomosis of the jejunum with the stomach is made at the lower border of the anterior surface, and instead of the attachment being made close to the commencement of the jejunum it has to be effected at least 12 to 15 in. from the

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flexure, since the jejunal loop has to pass over the transverse colon in order to reach the point of attachment to the stomach.

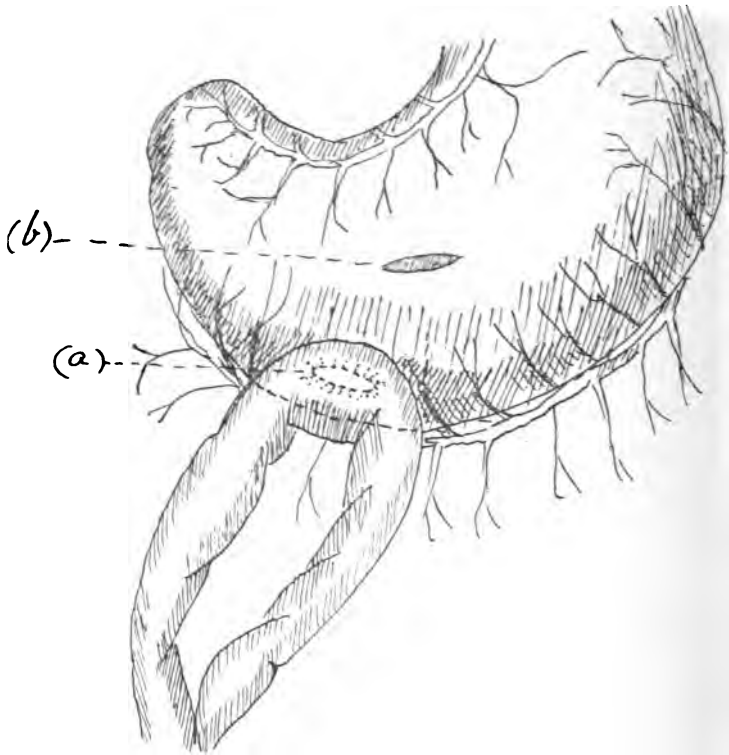

FIG. 16.—Anterior gastro-jejunostomy showing the correct position (*a*) and the incorrect position (*b*) for the anastomosis.

Otherwise, in the use of the clamps in the methods of attachment, whether by suture, by decalcified bone

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bobbin, by metal button, or by elastic ligature, it differs in no respect from the posterior operation.

The disadvantage, as we shall see later, is in the long loop of jejunum, which is apt to give rise to several complications. Personally, I always perform the posterior operation, except—

(1) When the meso-colon is very short, giving no room through which to make the anastomosis;

(2) When extensive and firm adhesions of the posterior wall of the stomach prevent a portion being drawn through a slit in the meso-colon; and

(3) When cancer invades the posterior wall so extensively as to leave no part of it safely available for operating on.

Entero-anastomosis of the jejunal loop.—This operation has been suggested as a means of preventing the vicious circle or of arresting it should it unfortunately have occurred.

In posterior gastro-enterostomy without a loop, or with a very short interval between the duodeno-jejunal flexure and the anastomosis, an entero-anastomosis is neither necessary nor desirable, as the vicious circle does not happen if the operation has been properly performed.

After the anterior operation with the necessarily long jejunal loop, stagnation of fluids may occur in it giving rise to regurgitant vomiting or to inflammation or ulceration of this part of the jejunum.

Some surgeons who regularly perform the anterior

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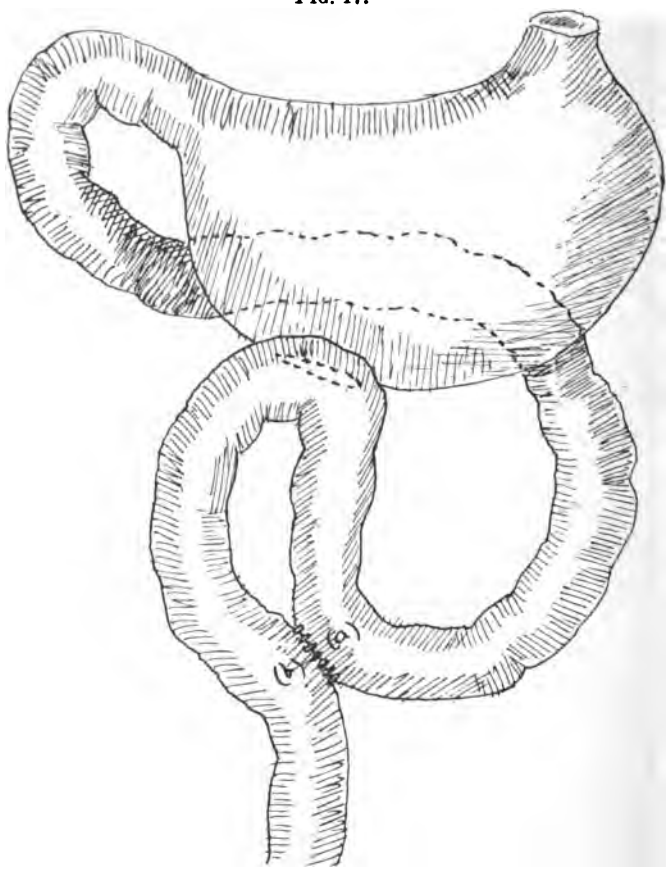
operation adopt entero-anastomosis as part of the technique, employing it as a preventive method.

FIG. 17.



I have only had to perform the operation on three occasions, and on each after anterior gastro-ente-

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rostomy, twice after my very early operations in which a long loop was employed, giving rise to regurgitant vomiting, which entero-anastomosis cured, and once, a year after operation by another surgeon, in which great pain and distress were caused by acute inflammation and ulceration of the whole of the long jejunal loop; in this case the condition was also relieved by the anastomosis. The operation is performed as follows: The lowest part of the ascending limb of the loop (*a*) is grasped by a rubber-covered clamp and approximated to a part (*b*) on the descending coil of jejunum beyond the gastro-jejunal opening, which is also clamped, and an opening of from 1 to 2 in. is made between one and the other in exactly the same way as already described for making the opening between the stomach and jejunum.

Roux's operation.—This method, which is also spoken of as the **Y** operation, was suggested and carried out by Roux, and is, I believe, still performed by him and by some other operators as a routine procedure.

At the International Surgical Congress held at Brussels, 1905, Von Eiselberg (2) stated that he always employed Roux's operation as a routine procedure.

This operation was invented when regurgitant vomiting or the vicious circle was a frequent complication of gastro-enterostomy, and then it was a

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distinctly useful modification, as it is still when a posterior gastro-enterostomy cannot be performed on

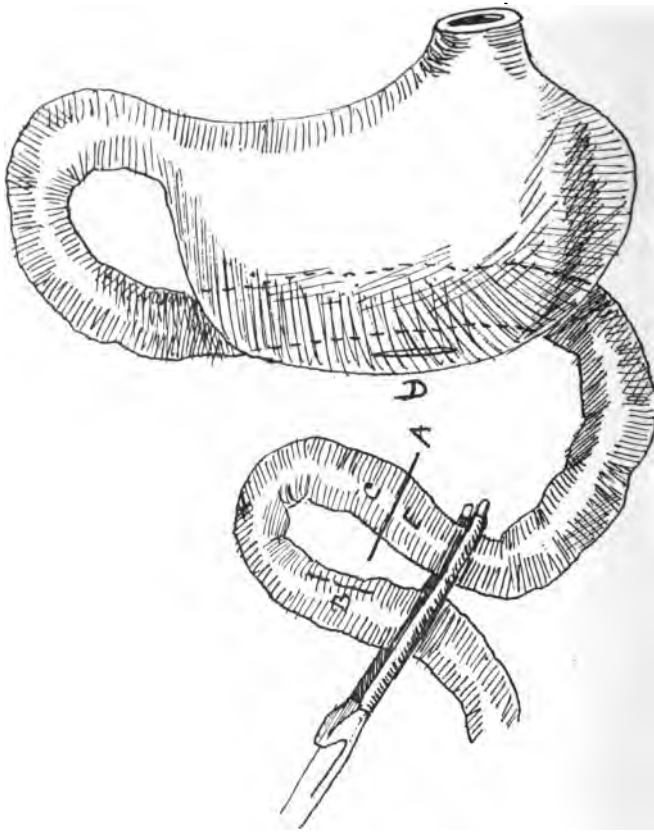

FIG. 18.—Roux's operation.

account of extensive adhesions or from extent of growth.

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As an ordinary procedure, Roux's operation is not necessary, and I think it undesirable, as it involves a double anastomosis.

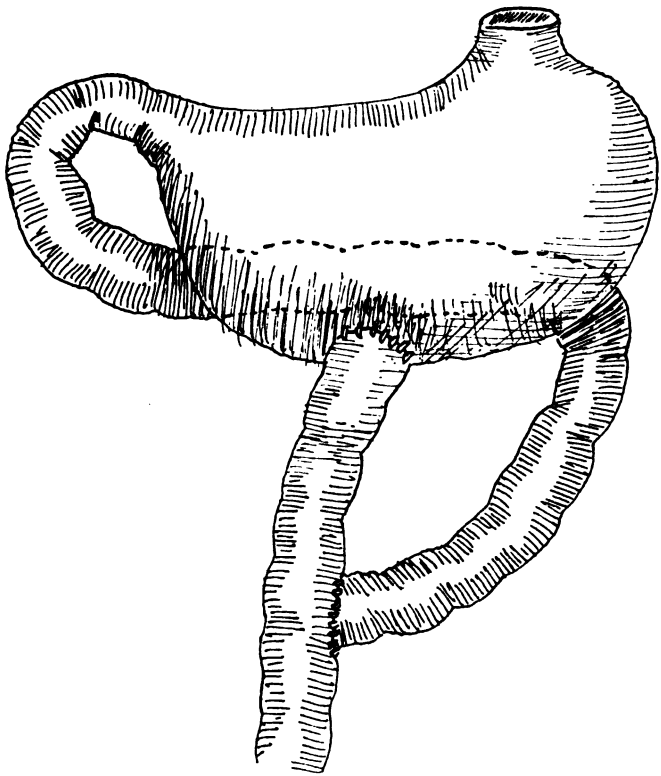

FIG. 19.—Roux's operation.

It may be performed as follows: After clamping the portion of stomach to which the anastomosis is to be made, a loop of jejunum of about 9 in., about

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10 in. from the duodeno-jejunal flexure, is grasped by a pair of long rubber-covered clamps.

This loop is divided at A; the open end of the bowel E is then sutured to a lateral opening made into the other arm of the loop at B. The open end C is then stitched to an opening made into the stomach at D.

When completed, the operation presents the appearance shown in the diagram.

I have carried out the procedure with advantage in extensive perigastritis with matting of the viscera, in wide-spread gastric carcinoma, and in jejunal ulcer where it was necessary to excise part of the ulcerated jejunal loop.

After-treatment.—When the patient is returned to bed he is propped up at an angle of about 30° by means of pillows placed under the back and shoulders. As soon as the effects of the anæsthetic have passed off the elevation may be increased to 45°. A narrow bolster, covered with jaconet and a linen bolster-case, is placed under the thighs and fastened to the upper bar at the top of the bed by means of webbing straps. This sling prevents the patient from slipping down in bed and also flexes the thighs and thus causes relaxation of the abdominal muscles. By maintaining the semi-sitting posture it largely contributes to the absence of post-operative vomiting, and at the same time relieves the breathing. If preferable the pillows may be taken out at night and the patient allowed to

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be at a lower angle on the right side, but it is wise to keep the patient propped up during the first twenty-four hours.

The gamgee leggings may be taken off, but the sleeves or jacket should be allowed to remain on for some days to prevent chilling. A warm nutrient, consisting of salt solution 1 pint, brandy 1 oz., liquid peptonoids 1 oz., is then administered. This is re-repeated every four hours during the first forty-eight hours with a less quantity or even without the brandy if thought desirable, after which it may be gradually discontinued. If the nutrient enemata are not retained simple saline nutrients should be tried. As soon as the patient has come round from the anæsthetic, feeding by the mouth may be commenced. Water, or better still, albumen-water, is given, ½ oz. at a time, every half hour. If there is no sickness or nausea the quantity is increased. Thirst may be relieved by permitting the patient to wash out the mouth frequently with water or soda-water. If there is severe abdominal pain, 10 gr. of aspirin should be given by the mouth and repeated, if necessary, in two or three hours. Morphine should not be given, as it is apt to cause sickness and distension of the intestines. The abdominal bandage, which is applied firmly after the operation, may have to be loosened to give greater comfort.

On the day after the operation the amount of food given is steadily increased. It is impossible to give

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a routine dietary for these cases, as the tastes of the patients have to be considered. The following may be taken as a basis for the feeding during the first week. Feeding during the night should be regular, unless the patient is asleep. It is only in exceptional cases that it is necessary to disturb the patient:

First day: Water, albumen-water, tea, ½ oz. to 1 oz. every half hour.

Second day: Ditto, with barley-water and plasmon; meat juice or jelly in teaspoonful doses; coffee containing a little cream or milk; whey with a little cream: 2 oz. feeds.

Third day: Ditto; broth with pounded chicken, Benger's food, made with milk.

Fourth day: Custard, junket, whey, milk jelly, tea or coffee, or any of above fluids that patient cares for.

Fifth day: Pounded chicken, fish, steamed or lightly-boiled eggs and bread crumbs; fluids as before.

Sixth day: Same as previous day, with the addition of milk pudding or brains.

Seventh day: Same as previous day. Bread and butter, toast and mashed potato and gravy may be given in small quantities. Pounded or finely-minced chicken and mutton in broth or in sandwiches can, as a rule, be allowed.

During the second week the amount of solid and liquid food is increased, with longer intervals between

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feeding. Care should be exercised in diet for some months: condiments should, as a rule, be avoided, and highly-seasoned or twice-cooked foods be eschewed.

After the operation the rectum is washed out every twenty-four hours with a pint of hot soapy water. Should there be distension of the abdomen from flatus, a tablespoonful of turpentine or 10 ♏ of oil of cajuput is added to the enema. No aperient is given as a routine measure, and as a rule none is given before the fourth day, but if one is required, that to which the patient has been accustomed is preferred. In some cases calomel, followed by a saline, in others cascara, and in others a compound aloin tablet may be required.

The time that a patient is kept in bed varies with the nature of the case. Old people, especially cancer patients, may often be allowed to sit up in a chair about the tenth day, though they may be moved on the sofa within a week. In these cases the abdominal wound must be firmly sewn up and supported by strapping. The average time for a patient to stay in bed after an operation on the stomach is from two to three weeks.

Complications.—The complications that may follow gastro-enterostomy are:

(1) Regurgitant vomiting.
(2) Contraction of the new orifice.
(3) Peptic jejunal ulcer.
(4) Pneumonia or other chest complications.

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(5) Adhesions.

(6) Intestinal obstruction.

(7) Non-union and separation of the anastomosed viscera.

(8) Hernia of the intestine through the loop in the anterior, or through the mesenteric slit in the posterior operation.

(9) Exhaustion.

(10) Hæmorrhage.

(11) Dragging on the jejunum when a dilated stomach retracts; this may occur if the ligament of Treiz is short or displaced to the right of the stomach and there is no jejunal loop (3).

(1) *Regurgitant vomiting.*—Regurgitant vomiting is a complication that used frequently to follow the operation of gastro-enterostomy, and when severe it was not infrequently fatal. It is now seldom and should never be seen, as it is entirely due to faulty technique.

It is essentially due to obstruction to the passage onwards of the duodenal contents, either from paresis of the intestine that has been handled too freely or paralysed by the too firm pressure of a faulty clamp; or to kinking of the bowel at the point of anastomosis; or to some obstruction by adhesions or pressure beyond the gastro-jejunal opening; or to the presence of a jejunal loop as in anterior gastro-enterostomy. It will thus be seen that the complication is, as a rule, due to intestinal obstruction or to stasis.

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The theories that have been put forward to account for it are:

(*a*) The presence of bile in the stomach, which Dastre's experiments on dogs absolutely disproved (4).

(*b*) The presence of a loop on the proximal side of the opening into the stomach, which is disproved by the large numbers of successful anterior gastro-enterostomies that must necessarily have such a loop.

(*c*) By the situation of the opening not being at a dependent part of the stomach, also disproved by many of the early successful cases in which the opening was not made close to the lower border of the stomach.

(*d*) The presence of pancreatic fluid in the stomach, disproved by Moynihan's case, in which a ruptured intestine at the duodeno-jejunal flexure was treated by closing both ends of the rupture and performing a gastro-jejunostomy, so that all the bile and pancreatic fluid regurgitated into the stomach through the pylorus for the fourteen weeks during which the patient survived the accident, without there being any signs of vicious circle (5).

(*e*) The formation of a spur at the point of anastomosis. This, by preventing the onward passage of the stomach contents, may undoubtedly be a cause, but it will not occur if the technique described on p. 152 is followed.

(*f*) Acute angulation of the jejunum beyond the anastomotic opening; a well-recognised cause, readily

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avoided by one or two anchor sutures beyond the opening.

(*g*) Pouting valves of mucous membrane. This may be a cause, but it is readily avoided by the proper application of the marginal suture securing apposition of the intestinal to the gastric mucous membrane.

(*h*) Compression of the colon by the jejunal loop in the anterior operation (Doyen).

(*i*) Adhesions forming subsequent to the operation leading to constriction of the distal arm of the jejunum, as in a case under my care in 1901, which was operated on six months later and cured by the division of a band crossing the distal jejunal loop (6).

It will thus be seen that the causes of the vicious circle are avoidable, and the complication should therefore seldom, if ever, occur; and, in fact, since recognising the cause in 1901 I have never seen a case of regurgitant vomiting in my practice.

Treatment of the vicious circle.—This should be preventive by accuracy of technique, and if the following points are observed the vicious circle will not occur:

(*a*) Accurate union of the mucous margins of the stomach and jejunum.

(*b*) Securing the anastomotic opening at or near the lower border of the stomach.

(*c*) Applying one or more anchor sutures beyond the point of anastomosis.

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(*d*) Bringing the distal loop of jejunum over to the right of the spine in arranging the peritoneal toilet before closing the abdomen.

(*e*) Making the anastomosis in the posterior operation either without a loop or with a very short interval between the anastomosis and the jejunal flexure.

(*f*) In the anterior operation the loop must not be made too short so as to compress the colon.

If the technique has been faulty, and unfortunately regurgitant vomiting should occur, what can be done?

(*a*) Raise the head and shoulders so as to prop up the patient in a semi-recumbent posture.

(*b*) Wash out the stomach and repeat it if necessary.

(*c*) Feed by the bowel and stop mouth-feeding for a time.

(*d*) Give small doses of calomel in repeated doses, followed by enemata, to try to secure a movement of the bowels.

(*e*) If these fail, do not wait too long before re-opening the abdomen and performing entero-anastomosis—an effectual method of treatment.

(2) *Subsequent contraction of the anastomotic opening.*—Although there may be moderate contraction of the new opening, both in cases where the stomach is greatly dilated before operation and in those where the pylorus is patent at the time of operation, yet if the anastomotic opening be made sufficiently large, not under 2 in., and the union of mucous membrane

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to mucous membrane be efficiently performed, contraction to a serious extent will not be likely to occur. I have always found the opening to be patent where I have at long periods subsequent to operation had to operate again for some other cause.

There have been a number of cases recorded (14) in which closure of the artificial opening has occurred within a short time after the use of Laplace's forceps, and in others at a later time after the use of the Murphy button, and after the employment of Senn's plates.

Dr. W. J. Mayo (12) in a paper read before the American Surgical Association in June, 1902, reported four cases in which contraction at the site of anastomosis took place. These all followed the use of the Murphy button and occurred in cases where the pylorus was not occluded.

In operations for ulcer of the stomach it seems highly probable that the reason for want of relief in some of the cases has been owing to the anastomotic opening being made of too small a size, under which circumstances any subsequent slight contraction becomes of serious moment. This was demonstrated satisfactorily by Mr. H. J. Paterson in his Hunterian Lectures delivered at the College of Surgeons in 1906 (13).

(3) *Peptic ulcer of the jejunum.*—The subject of peptic ulcer is an extremely interesting one that has given rise to much speculation and to many theories.

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In the stomach it is extremely common, in the duodenum probably much more frequent than hitherto supposed, but in the jejunum it is generally acknowledged to be very rarely found; in fact it was only in 1899 that Braun first described the formation of peptic ulcer in the jejunum of man, and although the subject has since received attention in Germany by Hahn, Kausch, Körte, and others, my own case reported before the Royal Medical and Chirurgical Society on April 12th, 1904, was the first described in English literature. In that paper I referred to several cases, but I know that Mikulicz has since reported other cases, and several additional ones were collected by Mr. Paterson in his Hunterian Lectures.

As all of these cases were perforating ulcers, it almost goes without saying that there must be many more that have existed unrecognised, and probably others that may have caused death by abscess, and in other ways in which the adhesions and other complications have so obscured the parts that even an autopsy has failed to elucidate the true nature of the disease.

The true cause of peptic ulcer, whether gastric, duodenal, or jejunal, is probably a mild form of sepsis leading to gastritis and excess of free HCl in the gastric juice. Traumatism, either by coarse food or through external injury, and interference with the circulation in the bowel have been assigned as

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causes, but without what seems to me adequate reasons.

Peptic ulcer is distinctly one of the sequelæ to be reckoned with after gastro-enterostomy. An analysis of the cases shows it to occur more frequently after the anterior than the posterior operation.

As excess of free hydrochloric acid is not found in cancer of the stomach (except in ulcus carcinomatosum) it is hardly likely that peptic ulcer of the jejunum will be found after gastro-jejunostomy for malignant disease, and so far as I know all the reported cases have occurred after operations for simple disease, especially ulcer. Nevertheless it is necessary to notice it here as one of the complications that may be met with.

As regards the frequency of peptic jejunal ulcers, out of nearly 300 posterior gastro-enterostomies which I have personally performed I have not had one example.

My single case occurred after an anterior gastro-enterostomy, 1 out of 30 that I have performed; and Kausch reported 2 out of 160 gastro-enterostomies performed in Professor Mikulicz's clinic, both being after anterior gastro-enterostomy.

Out of the 19 cases reported, the anterior operation had been done in 14, the posterior in 2, and the Y operation of Roux in 1; but whereas in the 2 cases of peptic ulcer occurring after the posterior operation, perforation was followed by general perito-

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nitis, in the 14 anterior operations the peritonitis was limited in 9 and diffuse only in 5.

The symptoms in my case were evidently chiefly referable to the perigastritis and the extensive adhesions, and although there was intense and agonising pain at times, it seemed to bear no relation to food: exquisite tenderness over the upper abdomen was a marked feature of the case.

Treatment of peptic jejunal ulcer.—In the cases of gastric ulcer that have failed to yield to medical treatment, and in which gastro-enterostomy has been performed, I fear that we have not properly grasped the fact that the operation is, though an important one, still only an incident in the treatment, which ought to be continued on general lines for some time longer, or until good health is again established. Greater attention to oral asepsis and to the gastric condition of hyperchlorhydria subsequent to operation is advisable, and in this way the very serious complication of peptic ulcer in the jejunum and relapses in gastric ulcer might be prevented.

In all the cases reported, perforation associated with acute, subacute, or chronic symptoms, has occurred; hence there can be no question as to the desirability—nay, as to the absolute necessity—of operation, which ought not to be delayed too long. When the abdomen is opened the treatment will depend on the condition found. If perforation has occurred into the general peritoneal cavity the con-

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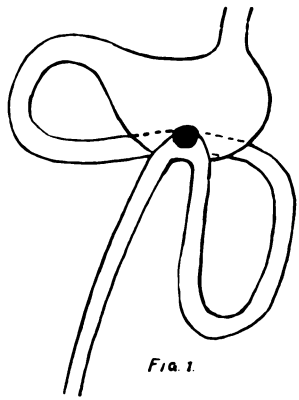

FIG. 1.

FIG. 2.

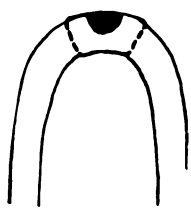

FIG. 3

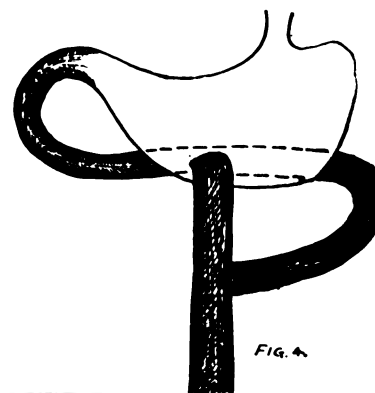

FIG. 4.

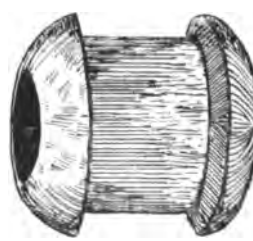

FIG. 5.

FIG. 20—1. Diagram of condition found on separating adhesions, May, 1903, showing perforation. 2. Diagram of portion of ulcer adherent to and detached from anterior abdominal wall. 3. Diagram of portion of intestine excised. 4. Diagram of anastomosis performed after the enterectomy. 5. Size of bobbins used. These five figures are from page 344, vol. lxxxvii, *Med.-Chir. Trans.*

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dition will be one of the utmost peril, and only capable of relief by immediate cleansing of the peritoneum and closure of the opening, or by excision of the ulcer, with subsequent suture.

Though peptic ulcer of the jejunum is less frequent after posterior gastro-enterostomy, only two cases having been recorded, when it does occur it is more likely to be acute and not to be limited by adhesions.

If, as in the greater number of cases, adhesions have formed, the condition will be less acute, although very distressing, from the associated pain due to perigastritis and adhesions. It will be necessary to detach adhesions and to repair the perforation, but probably in the greater number of cases, an excision of the portion of intestine involved and the performance of a Roux's operation will give the best results. In my case, which occurred three years and four months after an anterior gastro-enterostomy, I excised the portion of jejunum involved and performed a Roux's operation as shown in the accompanying diagrams. The operation was followed by recovery. I have operated on two other cases of jejunal ulcer after gastro-enterostomy performed elsewhere, but in neither of these cases had perforation taken place: both recovered.

(4) *Chest complications.*—Pneumonia or pleurisy are said to have followed operation on the stomach with greater frequency than in any other abdominal operations, the reason given being the difficulty of

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expanding the lungs in consequence of fixation of the ribs subsequent to operation.

My experience has not borne out this observation, for I have found chest complications to occur very seldom in my stomach operations, certainly not more frequently than after any other laparotomy. This may, perhaps, arise from the facts that I always have the patient enveloped in a gamgee tissue suit so as to avoid chilling during operation; have the head and shoulders well propped up by pillows after operation, and that chloroform is usually the anæsthetic employed. Moreover, in an old subject it is always desirable to turn the patient on the side from time to time, so as to avoid hypostatic congestion of the bases of the lungs.

(5) *Perforation, owing to want of union at the point of anastomosis.*—This is an extremely serious complication, and probably almost universally fatal. I have never known it to occur after union by suture, but once saw it happen some years ago in one of the few cases in which I employed the Murphy button, and Dr. W. J. Mayo has reported two cases that occurred under similar conditions. In one the accident followed an epileptic seizure on the ninth day, in the other on the seventh day after gastro-enterostomy for malignant disease of the pylorus.

Want of union used to be less rare when moribund patients were operated on, but it is seldom seen now except when the Murphy button has been used, in

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which case there is nothing to prevent extravasation if union be delayed beyond the first few days; whereas, if union is effected by a double line of sutures, delayed healing, if not too long, is not serious.

Mumford described a case of separation of the viscera in a case of posterior gastro-enterostomy performed by the no-loop method, which he ascribed to a short ligament of Treiz, so that when the dilated stomach contracted it forcibly dragged on the attached jejunum and led to separation.

(6) *Adhesions subsequent to gastro-enterostomy.*—Perigastritis, or adhesive peritonitis, at a distance from the site of operation is probably uncommon after aseptic operations, though adhesions may result from the use of strong antiseptics, or if hæmostasis is imperfect. Adhesions, the result of ulcer and cancer are extremely common, and I have seen them so extensive that it was almost impossible to find any healthy portion of the stomach to which the jejunum might be applied. Under these circumstances, a posterior gastro-enterostomy, on account of obliteration of the lesser peritoneal cavity, may be impossible, and it is better to perform a Roux's anterior Y operation. In one case of this kind, though an immediate successful result was obtained by a Roux's operation, the symptoms recurred some months later, evidently due to the formation of further adhesions. In another case that came under my care in 1891 I had to operate

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for bilious vomiting that came on some months after gastro-enterostomy, which I found on exploration was caused by a band stretching from the transverse colon and compressing the efferent jejunal loop, relief being given by the division of the band and an entero-anastomosis.

(7) *Internal herniæ.*—Internal herniæ after gastro-enterostomy may occur under three conditions:

(*a*) The passage of small intestine through the loop formed above the junction of the jejunum and stomach. This condition is only likely to occur after the anterior operation, as in a case reported by Dr. W. J. Mayo (12) in the *Annals of Surgery*, 1902. The accident happened a year after an anterior gastro-enterostomy.

(*b*) There are several cases on record of the passage of small intestine through the slit in the meso-colon made for the anastomosis in posterior gastro-enterostomy. A case of this kind occurred in one of Mr. Moynihan's patients, who died on the tenth day of acute intestinal obstruction, when a great part of the small intestines were found in the lesser peritoneal cavity (7).

In a second case occurring in his practice he opened the abdomen and reduced the hernia, the patient recovering.

The accident may be avoided by not making the opening too large and by suturing with two or three Pagenstecher's sutures the margin of the opening in

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the meso-colon to the line of junction of the stomach and jejunum.

Mr. A. E. Barker and Mr. W. Alexander have described cases of this accident (8).

(c) Mr. Barker (9) has recorded a case in which two years after a posterior gastro-enterostomy nearly the whole of the small intestines passed over the afferent loop and became strangulated.

Dr. H. M. W. Gray (15) found, in a case of acute obstruction after gastro-enterostomy in which he re-opened the abdomen on the seventh day subsequent to the original operation, that practically the whole of the small intestine had insinuated itself from left to right through the ring formed by the peritoneum of the under layer of the meso-colon, lining the posterior abdominal wall and forming the upper layer of the mesentery, the ring being completed anteriorly by the gastro-jejunal junction. It was easily pulled back and the ring closed by suturing the under layer of the meso-colon to the upper layer of the mesentery to prevent recurrence of the hernia. The patient recovered.

In the operation I have described such an accident could not occur, as there is no long jejunal loop.

(8) *Death from asthenia.*—In the eighties and early nineties it was considered absolutely essential to abstain from feeding by the mouth after any stomach operation, and as gastric operations were then always delayed until the patient was extremely weak, it fol-

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lowed as a necessary consequence that asthenia, or, in other words, starvation, was a real danger.

Asthenia from this cause is now seldom seen, as feeding is begun immediately the patient has recovered from the anæsthetic. In my own practice I do not hesitate to let the patients have liquid or semi-liquid nourishment in small quantities every half hour as soon as they can take it, and seeing that in gastro-enterostomy anæsthetic vomiting does not occur, the patient is usually able to have some food within four hours of the operation, this being supplemented by nutrient enemata of normal saline solution containing liquid peptonoids and brandy. (See after-treatment and feeding after gastro-enterostomy, p. 168.)

(9) *Hæmorrhage.*—Hæmorrhage as a cause of death after gastro-enterostomy is not likely to occur as the result of the operation itself, as the continuous suture applied through the whole thickness of the margins of the anastomotic opening acts as an efficient compress to the vessels. It may, however, occur from ulcer or cancer just as it might have happened had no operation been done in such cases. The administration of adrenalin, the abstention from mouth-feeding, and the injection of lactate of calcium under the skin or by rectal enemata will be found useful, and the treatment will be as in other cases of hæmatemesis or melæna. Should the bleeding persist, the question of further operation will arise, in order to discover and treat the bleeding points.

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The after-results of gastro-jejunostomy.—(1) In considering the various complications, it seems quite definitely proved that the use of the Murphy button is attended with uncertain results, both on account of the subsequent tendency to contraction of the anastomotic opening and the retention of the metal instrument in the stomach.

(2) If the anastomotic opening be made of too small a size it is apt to prove unsatisfactory and to lead to relapse.

(3) The methods which do not secure continuity of the mucous membranes of the anastomosed viscera are apt to be followed by undue contraction or even complete closure of the new passage.

(4) The risk of peptic jejunal ulcer, even after all the methods that have been described, is probably under 2 per cent., but if the posterior operation be performed and the anastomotic opening be made sufficiently large, the risk is hardly appreciable, certainly nothing like 1 per cent.

(5) If the method of union by suture that I have described be performed, and the opening be made of sufficient size, considerably over 90 per cent. of patients suffering from pyloric stenosis of a simple character, or from gastric ulcer, will be completely and permanently relieved of their symptoms, and those suffering from cancer should derive considerable relief. I have had cancer cases to survive for over two years, and to lose all pain and discomfort for long periods.

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(6) As a number of patients suffering from non-malignant diseases have regained their normal weight and lived for many years in good health—some even for twenty years—there seems to be no reason to suppose that the operation of gastro-enterostomy *per se* tends to shorten life.

Chemico-pathological evidence. — The experiments performed by Joslin (10) were carried out on patients who had had gastro-enterostomy performed for cancer of the pylorus. His conclusions, therefore, which seem to prove that the operation leads to a marked diminution of absorption of nitrogenous foods as well as of fats and hydro-carbons, cannot be taken seriously, as cancer itself is capable of producing these results. Moreover, Mr. H. J. Paterson and Dr. Francis Goodbody (11) carried out a series of experiments on four patients in whom gastro-enterostomy had been performed for simple disease of the stomach, which proved very clearly that metabolism is practically unaffected after gastro-jejunostomy, as in none of the cases did the unabsorbed nitrogen amount to more than 2 per cent. above the amount usually passed in the fæces by a healthy individual, while the amount of fat passed unabsorbed did not on any occasion exceed 7·7 per cent. of the fat taken in the food, that is, just over 2 per cent. above the amount usually passed in the fæces by a healthy man.

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CHAPTER XI

GASTROSTOMY

The operation of gastrostomy is designed to make an artificial opening in the stomach, through which a patient may be fed when, for various reasons, food cannot be taken in the ordinary way. It was first suggested by Egeberg in 1837, but was first carried out by Sedillot in 1849. In 1875 Sydney Jones performed the operation, and the patient survived sixteen days, but Verneuil, in 1876, had a patient to survive for sixteen months.

Survival after gastrostomy for cancer of the œsophagus does not often exceed a few months, though I have had a patient to live for a little over a year.

After the operation for simple stenosis, life may, however, be prolonged for years; one of my patients is living seven years later, and I have heard of one surviving for ten years, all the food being taken through the artificial opening.

Indications.—(1) Cancer of œsophagus or pharynx, causing obstruction to swallowing of food.

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(2) Simple stenosis of pharynx or œsophagus, after swallowing of caustic fluids or from syphilis or other cause, which cannot be kept patent by bougies.

(3) Cancer of cardiac end of stomach leading to difficulty of entrance of food into the stomach.

(4) It has been suggested as a palliative procedure in extensive cancer within the mouth or pharynx in which, although swallowing of food is possible, it can only be accomplished with great pain.

The operation is most useful, but was for long held in disrepute for two reasons: First, from the custom to delay gastrostomy until the patient was in the last stage of exhaustion, when naturally the mortality was very great; and secondly, when a direct opening into the stomach used to be made, leakage of the stomach contents with consequent irritation of the skin around the fistula made the remainder of life, in case of survival, so miserable that it was thought to be scarcely worth while to recommend it.

With improved technique, however, the operation is rendered both safe and efficient.

The operation I am accustomed to perform is very simple, and only occupies a few minutes; if needful it can be done under local anæsthesia (1). It is a modification of the Ssabanejew-Franck operation, and has given me very good results—twenty-three recoveries out of twenty-four operations performed since 1897.

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A vertical incision of about 1½ in. is made over the outer third of the left rectus abdominis, commencing ¾ in. below the costal margin; the fibres of the rectus are separated, but not divided, to the extent of the

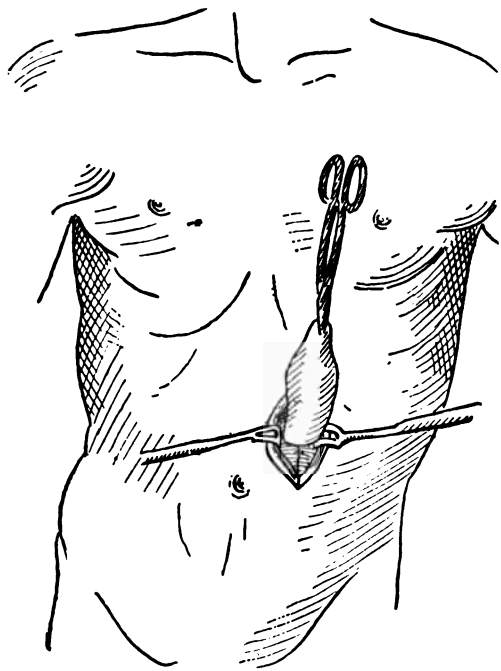

FIG. 21.—Gastrostomy. (Franck's method modified by the author.)

incision, and the posterior part of the rectus sheath and peritoneum are divided together, the opening being 1 in. in length. A portion of the cardiac end of the stomach is then brought up through the wound

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and held forward by an assistant until four sutures are inserted into the base of the cone by means of a curved intestinal needle so as to fix the visceral peritoneum of the stomach to the edges of the parietal

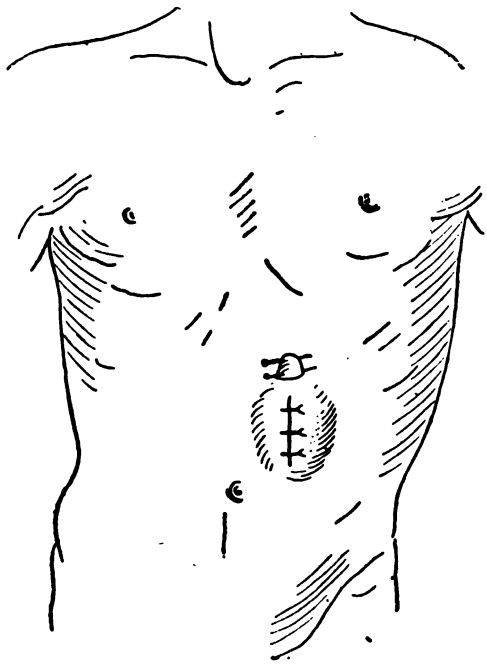

FIG. 22.—Gastrostomy. (Franck's method modified.)

peritoneum. A transverse incision of $\frac{1}{2}$ in. is then made through the skin 1 in. above the upper end of the first cut, and by means of a blunt instrument, such as the handle of a scalpel, the skin is undermined so as to connect the two openings beneath the

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bridge of skin and subcutaneous tissue. A closed pair of pressure forceps is introduced through the upper incision as far as the projecting part of the stomach, and made to grasp the most prominent part,

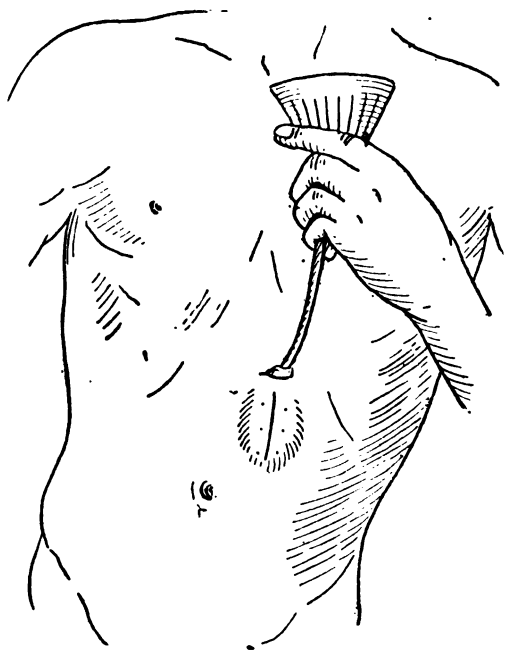

Fig. 23.—Gastrostomy. (Franck's method modified.)

which it draws up to and beyond the surface of the second opening, where it is retained by means of two hare-lip pins. It should just fill the opening, and should require no sutures. The lower opening is now closed by two or three silkworm-gut sutures, or by a

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continuous stitch, and by Michel's clips, and the edges are dried and covered with collodion and gauze. The stomach is opened at once by a tenotomy knife introduced between the pins. After opening the stomach, a Jacques catheter, from a No. 8 to No. 12, is inserted, to which a piece of rubber tubing is fixed, and by means of a funnel the patient can at once be fed with warm milk and egg, or whatever liquid may be thought desirable. The catheter may be left in position for a few days, after which it is easy to insert it whenever a meal is required.

E. J. Senn's method (2) : The stomach being exposed, an incision about 1 in. in length is made into its cavity as near the cardia as possible, and midway between the greater and lesser curvatures. A tube equal to a No. 12 or No. 14 catheter is now introduced into the stomach and there fixed by a suture, which includes the cut edge of the stomach and the side of the tube. In order to infold the tube in the stomach wall, a purse-string suture is passed round the tube at a distance of ½ in. from it. The tube is pushed inwards towards the stomach cavity while the suture is tied. A second purse-string suture, and then a third, are passed and tied in the same manner. The result is that the tube lies in a funnel-shaped inverted portion of the anterior wall of the stomach, and is there fixed by the sutures placed one above the other. The stomach is now fixed to the anterior abdominal wall by a suture above and a

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suture below the tube, and the abdominal incision is closed in the usual manner. The advantage of this

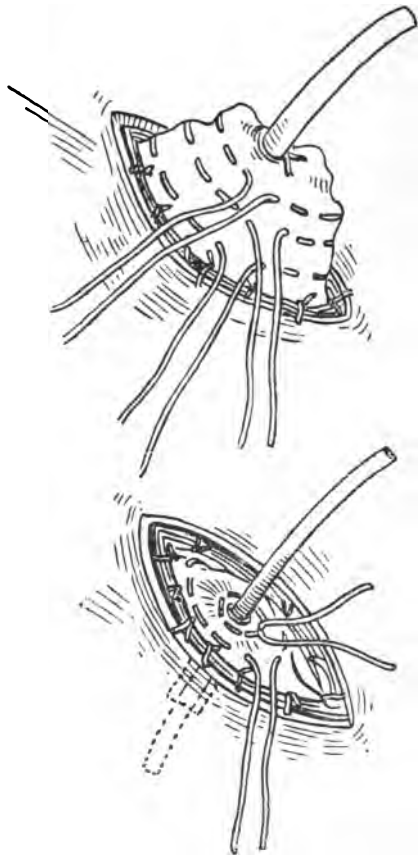

FIG. 24.—Gastrostomy. (Senn's method.)

method over Franck's, or its modification, lies in the fact that as the portion of the anterior stomach wall

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used for the purpose of effecting valvular action is pushed inwards instead of being dragged outwards,

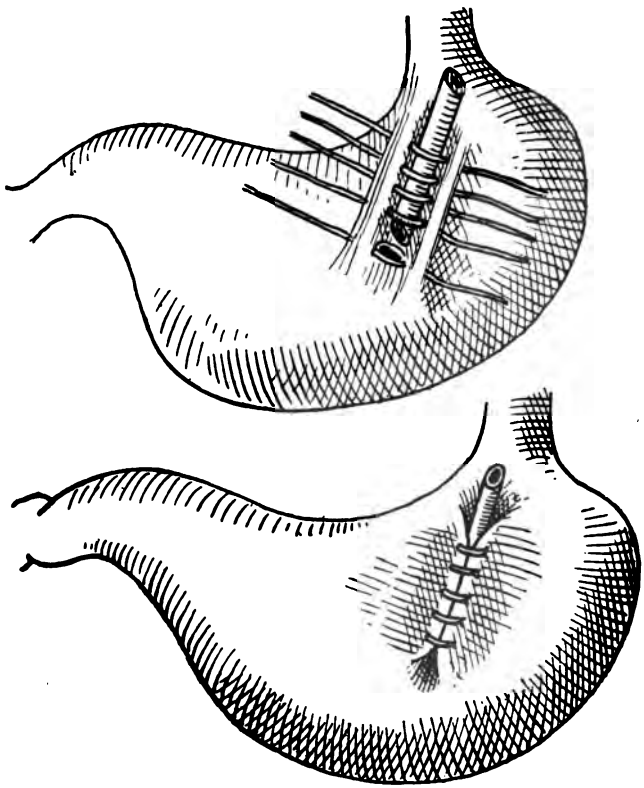

FIG. 25.—Gastrostomy. (Witzel's method.)

a larger cavity is left for the reception of food, and the area of the gastric mucosa brought into contact with the food is therefore more extensive. I can

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recommend this method as at once easy, safe, and efficient.

Witzel's method (3): An incision, parallel to the costal margin, is made until the rectus muscle is reached. The fibres of the muscle are split vertically and the peritoneum opened. The stomach is exposed and drawn out of the wound; a small incision is made into the stomach, a tube introduced and fixed by a single catgut suture. The tube is then laid upon the stomach wall for a distance of 2 in., or rather more, and a gutter is made for it by raising up a fold on each side and stitching the folds over the tube. The tube then opens into the stomach in the same manner as the ureter opens into the bladder. The stomach is fixed to the abdominal wall by two or three sutures. Mikulicz and Helferich have shown that after the lapse of a few months the oblique passage for the tube becomes a direct one, the inner orifice lying behind the outer.

Kader's method (4): The stomach is exposed through Fenger's incision, a cut is made into it, and a tube introduced and fixed by a single catgut stitch. Two parallel folds of the stomach are then raised up, one on each side of the tube, and their summits are sutured by two or three Lembert sutures above, and the same number below the tube. The sutures are cut short. Two similar parallel folds are again raised up and again stitched, and if necessary a third tier is added. A most efficient

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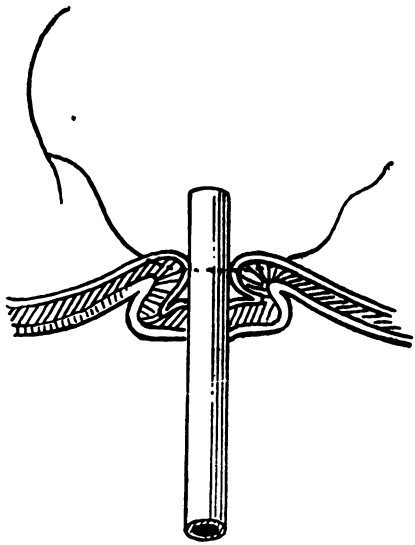

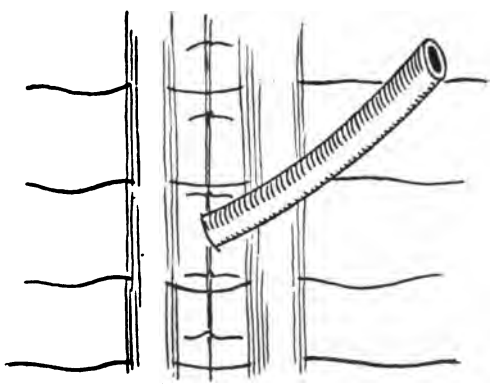

FIG. 26.—Gastrostomy. (Kader's method.)

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valve is thus formed. The stomach is fixed by one or two sutures to the anterior abdominal wall.

A. Depage (4) devised the following operation, which he successfully performed in a case of cancer of the upper part of the œsophagus when solid food could not be taken: A vertical incision 7 or 8 cm. long is made a little to the left of the middle line and at the seat of election. After opening the abdominal cavity, a portion of the stomach is drawn out and separated from the peritoneal cavity by a continuous suture which unites the wall of the organ to the edge of the peritoneum. A flap with its base upward is then cut out of the anterior wall of the stomach. This can be easily done by pinching up a piece of the wall between pressure forceps and cutting along the blades. The flap is then turned upward and the incision in the stomach is closed by a continuous suture, carried first only through the mucous coat. The serous layer is sutured in the same way. Each of the sutures is continued on to the flap, which is in this way transformed into a canal. The canal thus made is fixed to the abdominal wall, or if long enough it may be drawn through a parietal tunnel near to the xiphoid cartilage. The abdominal incision is then sutured and a sound is introduced into the canal, and may be left there or inserted before each meal.

This somewhat complicated operation is more difficult to perform, and at the same time is not

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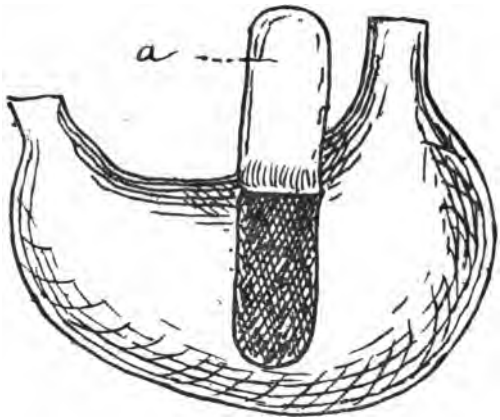

FIG. 27.—Depage's Gastrostomy.
a, the flap raised from the anterior wall of the stomach.

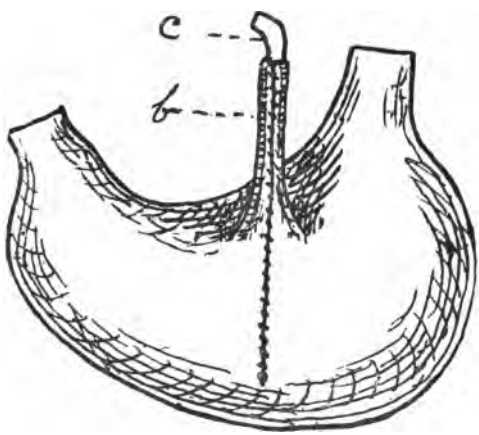

FIG. 28.—Depage's Gastrostomy.
The edges of the incision sutured together, and the flap transformed into a canal (*b*), through which a sound (*c*) is passed.

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more efficient than the other operations just described.

In all these methods a Jacques catheter, closed by a clip, should always be kept in the stomach for some length of time after operation, as the opening so readily contracts. In a recent case I have efficiently kept the opening patent by a short, solid, india-rubber plug, similar to the form employed for keeping open a sinus in the antrum.

I have performed my modified operation on many occasions and with most satisfactory results. Little or no shock is experienced, as although the peritoneum is opened there is neither exposure of viscera nor handling of any organ except the portion of stomach to be fixed, and I have never known peritonitis to follow.

Where the operation is not deferred until "too late," death should not occur except from some accidental complication: for instance, I lost a patient at the end of the first week after gastrostomy for cancer of the œsophagus from the unusual occurrence of an abscess caused by suppurating glands bursting into the trachea and flooding the bronchial tubes with pus. In that case I saw the patient in the morning, when he expressed himself as, and looked to be, doing well, and yet on returning in a few hours he was suffering from dyspnœa, was cyanosed and almost pulseless—in fact he died, drowned by pus, within six hours of the rupture.

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Even after gastrostomy for malignant stricture of the œsophagus I have seen as much as 1½ st. to be gained in weight.

In one case in which I performed gastrostomy nearly seven years ago for what was supposed to be a malignant stricture, the patient gained his health and weight completely, and some time afterwards he regained the power of swallowing a little fluid, not sufficient, however, to support life, and he still makes use of his gastrostomy opening for feeding purposes. He has a mere dimple to represent the site of the stomach fistula, into which he inserts without the slightest difficulty a No. 12 catheter *a boule*. There is no irritation around the opening, and even after so long a time there is no leakage of food or gastric fluid, so that he does not find it necessary to wear any apparatus or to have any dressing applied.

In advocating the earlier and more frequent performance of the operation of gastrostomy in cases of dysphagia incapable of relief by ordinary means, I feel that I can do so as the result of ample experience of its beneficial results.

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CHAPTER XII

JEJUNOSTOMY

JEJUNOSTOMY is an operation occasionally called for as a means of giving relief and prolonging life in patients suffering from advanced disease of the stomach, where on exploration it is discovered to be impracticable to perform gastrectomy, gastrostomy, or gastro-enterostomy. The indications for the operation in cancer cases are :

(1) Extensive cancer of the stomach too advanced for gastrectomy, and in which no healthy spot of sufficient size on the stomach wall can be found for the purpose of gastrostomy or gastro-enterostomy.

(2) After complete gastrectomy, when it has been impossible to satisfactorily unite the œsophagus to the intestine.

In non-malignant cases it may be required in :

(1) General cicatricial contraction of the stomach, simple in character, and due to the swallowing of caustic fluid, in which the stomach has been so far damaged that it no longer performs its functions or even allows of the proper passage onwards of food.

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(2) In very extensive gastric ulceration with deformity of the stomach, as in hour-glass contraction, where it is impracticable to perform any of the ordinary operations with probability of success.

(3) As a means of giving the stomach and duodenum rest in severe hæmatemesis or melæna, when a longer operation could not be borne.

It has also been suggested in pronounced hyperchlorhydria in preference to gastro-enterostomy in order to avoid peptic ulcer of the jejunum; but as the latter is extremely rare and practically only associated with anterior gastro-enterostomy—a method that is being replaced by the posterior operation—I do not think surgeons generally will be likely to endorse Neumann's suggestion.

Operation.—For any operation to be a success the bowel must be so placed that it will serve the two purposes:

(1) To permit the passage onward of the bile and pancreatic fluid poured into the intestine above the artificial fistula.

(2) To allow of food being introduced through the fistula without fear of regurgitation, either of the food or of the intestinal contents.

In my first operation, performed in 1891, I used a method which, though successful in prolonging life, was inconvenient and cumbersome, and I need not mention it further. The operations now used are:

(1) A modification of Witzel's method of gas-

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trostomy, in which a No. 12 rubber catheter is stitched into an opening in the jejunum, and after-

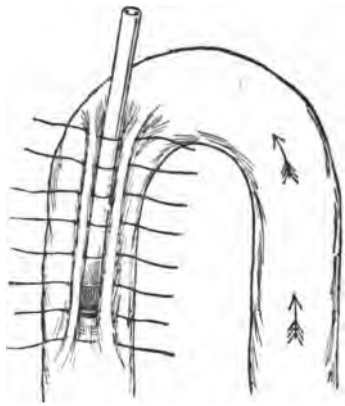

FIG. 29.—A method of performing jejunostomy by a modification of Witzel's operation for gastrostomy. First stage.

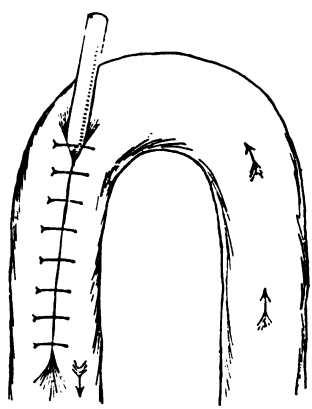

FIG. 30.—Second stage of Fig. 29.

wards the catheter is buried in a groove in the bowel for a distance of about 2 in., the line of suture

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being fixed to the abdominal wall (see Figs. 29 and 30).

(2) Maydl's method of dividing the jejunum, implanting the proximal cut end into the distal portion a few inches from the original line of section, the open end of this section being fixed to the skin (Fig. 31).

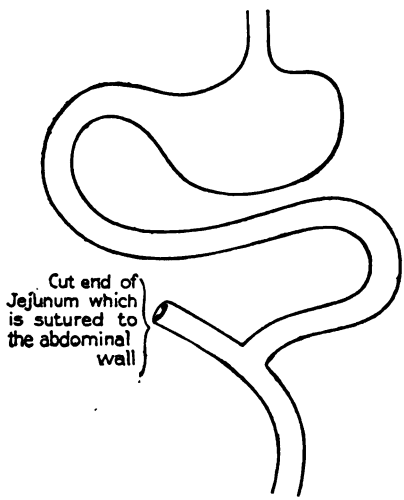

FIG. 31.—Jejunostomy by Maydl's method.
These three figures are from pages 234 and 235, vol. lxxxviii, *Med.-Chir. Trans.*

(3) Mayo-Robson's method. It consists in taking a loop of the beginning of the jejunum just sufficiently long to reach the surface without tension; the two arms of the loop are short-circuited about 3 or 4 in. from the surface, the short-circuiting being done either by means of sutures around a decalcified bone

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bobbin or by sutures alone; personally I prefer the former. A small incision is then made into the top of the loop, just large enough to admit a No. 12 Jacques catheter, which is inserted and passed for

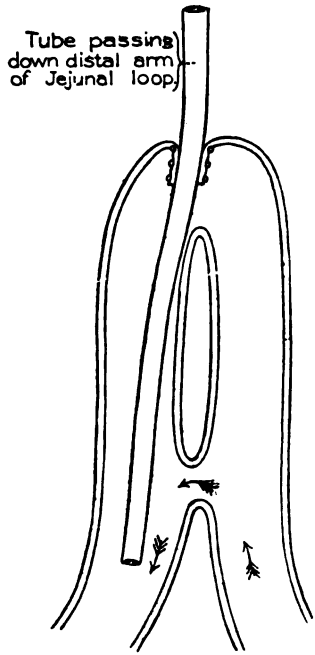

FIG. 32.—Jejunostomy by the author's method now described. This figure is from page 236, vol. lxxxviii, *Med.-Chir. Trans.*

3 in. down the distal arm of the loop; this is fixed to the margins of the incision in the gut by a silk or Pagenstecher's suture, and the entrance of the tube into the bowel further guarded by two

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purse-string sutures, one over the other. The top of loop is fixed to the skin by one or two stitches and the wound closed. The patient can then be fed at once with some peptonised milk and brandy. The whole operation can be done in from fifteen to twenty minutes, and with very little visceral exposure.

Should the patient be too ill to bear the little extra time occupied by the short-circuiting, the tube may be inserted as directed, and surrounded by two or three purse-string sutures, a proceeding which can be accomplished in a few minutes. In this case the loop of bowel must not be brought to the skin, but had better be fixed by sutures to the peritoneal margin and the aponeurosis, in order to leave part of the lumen of the attached loop within the abdomen for the direct passage onwards of the intestinal fluid with the bile and pancreatic secretion.

The following case affords an example of the relief that may follow this operation :

Mrs. —, aged forty-six years, the wife of a sea captain, was sent to see me on April 8th, 1904, when she was suffering great pain, which came on at frequent intervals, and she was vomiting five or six times a day—in fact, whenever she took food it was shortly vomited, the vomit being at times coffee-ground in character. A tumour in the epigastrium about the size of a large flat orange could be readily felt, and at short intervals the whole stomach became

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hard and rigid. No enlarged glands could be felt in the groin or above the clavicle. There was no tenderness on pressure, and the hard, nodular tumour was suggestive of cancer. Though she gave a history of indigestion and loss of health for eight years or even longer, the acute symptoms had only existed for six months.

On April 13th the abdomen was opened by a vertical incision through the inner margin of the right rectus, when the stomach was found to be involved in cancer from end to end. As the glands along the lesser curvature were involved, and secondary growth could be felt passing up through the opening in the diaphragm, and a number of enlarged glands could be seen in the great omentum, it was clearly impossible to perform gastrectomy and impracticable to do a gastro-enterostomy. A loop of jejunum was, therefore, brought up and short-circuited by suture over a decalcified bone bobbin and a No. 12 Jacques catheter was inserted as just described. The wound was rapidly closed and the patient was put to bed in good condition, the whole operation only having occupied half an hour or less. A meal of peptonised milk was given at once and repeated every two hours. From the time of operation the vomiting ceased, and she completely lost her pain. Fifteen days after operation she was able to take a little food by the mouth, though the feeding was chiefly by the tube.

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She was free from pain and the tumour was less. She returned home on the nineteenth day, having gained flesh and strength. Six months later I had a letter saying that she was able to get about and could take plenty of food, partly by the mouth and partly through the tube. She had gained considerably in weight, though the gastric tumour could still be felt. The patient survived for twelve months, ten or eleven of which were passed in comfort. Her death was due to secondary growths in the abdomen.

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CHAPTER XIII

GASTRO-ŒSOPHAGOSTOMY

In certain cases of impermeable cicatricial stenosis of the lower end of the œsophagus, and in case of cancerous stenosis, whether involving the œsophagus alone or the cardiac end of the stomach along with it, surgery has hitherto been impotent so far as a radical operation is concerned, and such cases have been treated in the past by gastrostomy. Now that the pneumatic chamber has become a more practicable help to the surgeon, I think we may look forward to accomplishing in man what has been proved possible in the lower animals.

Sauerbruck (1) has published the results of some of these experiments on dogs, which have been carried out with complete success, although the first attempts made by Mikulicz led to scepticism as to the possibility of such operations.

The conditions necessary to success appear to be perfect asepsis and accurate anastomosis, in which the Murphy button has played a part, but which might doubtless be accomplished by simple suture or

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by the use of continuous sutures over a decalcified bone bobbin. Sauerbruck made a free application of Lugot's solution to the surface to be anastomosed in order to secure rapid adhesion.

The following are the different steps of the experimental operation for establishing an anastomosis between the cardiac end of the stomach and the thoracic œsophagus:

(1) A long incision through skin, muscle, and pleura is made between the fifth and sixth left ribs.

(2) These two ribs are forcibly separated and the œsophagus, aorta, and both vagi are freely exposed.

(3) The pleural and peritoneal coverings having been divided, a conical portion of the cardiac end of the stomach is drawn through the œsophageal opening of the diaphragm into the thoracic cavity.

(4) Into the lip of this displaced portion of the stomach the female segment of a Murphy's button is inserted through the smallest possible opening.

(5) The male portion of the button is next inserted into that portion of the œsophagus to which it is intended to fix the stomach.

(6) The anastomosis having been made by bringing the two segments of the button together, the base of the prolapsed cone of stomach is fixed by sutures to the margin of the orifice in the diaphragm.

(7) Lugot's solution is applied to the raw surfaces, and the cavity of the wound having been washed out with saline solution is completely closed by sutures.

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Of thirteen dogs thus treated, ten recovered, whilst the remaining three died in consequence of complete hernia of the stomach into the thoracic cavity, due to faulty suturing of the small conical prolapse to the œsophageal opening in the diaphragm. Sauerbruck found in these experiments that the stomach could be readily applied to the upper third of the œsophagus, and that the lower half of this canal could be excluded by anastomosis.

Partial resection of the œsophagus was found to be a very difficult and unsatisfactory operation on account of the inelasticity of the canal and its close attachment to surrounding structures, and of the consequent impossibility of bringing the divided ends together and of maintaining them in contact by sutures. It is not difficult, however, after the stomach has been fixed to the upper part of the thoracic œsophagus, to resect the canal below the seat of anastomosis, and finally to invert the lower end into the cavity of the stomach, and to cover it by a row of peritoneal sutures. The upper end of the divided œsophagus is secured by a ligature. This operation was performed on eleven dogs without a single fatal result. For the removal of a close stricture or of a small tumour situated at the lower end, Sauerbruck suggests the following procedure, to be carried out in two stages: In the first stage the affected portion of the œsophagus, after it has been exposed by thoracotomy within the pneumatic chamber, is inverted into the interior of

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the stomach and retained in this position by sutures. After an interval of about a fortnight, gastrotomy is performed and the inverted portion of strictured or diseased œsophagus excised. That such operations as are here described are practicable on man Sauerbruck has convinced himself by experiments on the human cadaver. The stomach, he states, is sufficiently mobile, the œsophagus can be readily separated from surrounding nerves and vessels, and sufficient exposure can be attained by a single incision in the fourth or fifth intercostal space.

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